Civil Aviation Organization
Accident Investigation and Analysis Office

Final Investigation Report of the accident on January 9th, 2011 of a Boeing 727-286, registered EP-IRP, belonging to Iran Air, which crashed in Urmia, Iran.

Finished on December 9th, 2012

Translated by Bardia H.

Note: The Pages are only a direct translation of what has been written in the Report.
These pages aren't factually correct, as this translated report doesn't have the same amount of pages as the actual report.

Group in this Table means the group of Investigators, what they investigated, and what they found/concluded.

Foreword

The Civil Aviation Organization of the country, based on international commitments and domestic regulatory frameworks of the Islamic Republic of Iran, is responsible for monitoring the implementation of laws, regulations, and flight standards in the non-military aviation industry of the country. In this regard, in order to identify sources of safety hazards and improve aviation safety, it conducts investigations of accidents and incidents based on international regulations and ICAO standards, as well as the operational procedures of the Safety Office and the Aircraft Accident Investigation Department of the Iranian Civil Aviation Organization.

The occurrence of aviation accidents and incidents is subject to review and data analysis, and after identifying the main causes and contributing factors, safety recommendations are issued to ensure compliance with standards and regulations in order to prevent the recurrence of similar incidents in the future.

The provisions of this document and the instructions derived from ICAO Annexes and the national civil aviation regulations (ICAR 113) emphasize the need to analyze and provide results for determining safety-related causes in accident investigations. However, these findings are not meant for judicial or punitive purposes. The only objective of investigating an accident or incident is to determine its causes and contributing factors in order to issue safety recommendations aimed at preventing similar occurrences in the future.

The sole objective of the investigation of an accident or incident shall be the prevention of accident and incident. It is not the purpose of this activity to apportion blame or liability.

Regarding the accident on January 9, 2011, involving a Boeing 727 aircraft belonging to Iran Air, which occurred near an airport in Urumiye at 16:01 UTC, the initial investigation of the site was conducted as soon as possible to gather necessary information. After collecting the required documentation from the accident site, the wreckage was transferred from the Accident Location in Urumiye for further analysis by expert teams.

Following this, the investigation team held multiple and diverse sessions regarding the responsibilities of the relevant entities. They also engaged in discussions with emergency response teams, airport security personnel, and local residents near the crash site to collect additional information.

Ultimately, after an extensive review by technical, operational, and safety experts, a comprehensive and detailed report was prepared. This report, based on the investigation of the accident site, aircraft wreckage, and contributing factors, led to the issuance of safety recommendations aimed at preventing similar accidents in the future.

It is hoped that the responsible authorities of the sacred system of the Islamic Republic of Iran and those involved in the aviation industry, along with executive managers, will implement and utilize the safety recommendations presented in this final report to improve and enhance aviation safety everywhere, following the path set by previous reports.

Additionally, in the investigation of this accident, and in coordination with obtaining the necessary permits related to the relevant materials from the U.S. Department of Transportation, the National Transportation Safety Board (NTSB) of the United States was invited as the country of the aircraft's designer and manufacturer.

Mr. Josef Sedor was introduced as the Accredited Representative of the NTSB in the accident investigation. Furthermore, it was announced in writing that consultants from Boeing (the aircraft manufacturer), Pratt & Whitney (the engine manufacturer), and Honeywell (the manufacturer of the FDR & CVR), after obtaining permission from the U.S. Congress (for exemption from sanctions), would be introduced to assist in the accident investigation.

In the end, due to the lack of approval for this investigation, these consultants did not participate in the accident review.

Synopsis

Aircraft Type: Boeing 727-286
Registration: EP-IRP
Owner and Operating Airline: Iran Air
Date of Occurrence: January 9th, 2011
Time of Occurrence: 19:31:49 local time (16:01:49 UTC)
Location of Occurrence: Near Urumiye Airport
Damage to Aircraft: Total Destruction of Airplane
Number of People on Board: 105
Number of Crew: 9
Number of Fatalities: 78
Number of Survivors: 27
Investigation Responsibility: Office of Safety and Accident Investigation
Cause of Accident: Adverse weather Conditions affecting the Aircraft and improper handling by the Cockpit Crew (Pilots).

1. Factual Information

1.1 History of the Flight

On Sunday, January 9th, 2011, at 18:33:25 local time,(15:03:25 UTC), a Boeing 727 aircraft operated by Islamic Republic of Iran Airlines, flight number IRA277, took off from Mehrabad Airport with 105 occupants. The flight was bound for Urmia via routes G781 and UL125.

After coordinating with Tehran Control Center, the aircraft continued its route and, at 15:42:00 UTC, began descending for approach to Urmia Airport. At 15:55:39 UTC, the aircraft contacted Urmia Tower (TWR) and was cleared to execute the TUBAR2A arrival procedure and the VOR/DME/ILS approach.

At 16:01:08 UTC, the crew requested a missed approach and announced their intention to return to Tehran. A few minutes later, the aircraft crashed near the villages of Mushkabad-e Olya and Hasanlu, approximately 30 kilometers from Urmia Airport, at a radial of 150 degrees from the VOR.

1.1.1 Flight Description

- At 14:11:28 UTC, the aircraft established its first contact with the Delivery unit at Mehrabad Airport.
- At 14:32:34 UTC, the crew requested permission to start the engines.
- At 14:52:00 UTC, the crew requested taxi clearance from the Ground (GND) unit.
- At 15:03:25 UTC, the aircraft began taxiing on runway 29 at Mehrabad Airport. The engine power settings were: Engine 1 at 1.09 EPR, Engine 2 at 1.13 EPR, and Engine 3 at 1.11 EPR.
- At 15:03:25 UTC, the aircraft lifted off at a speed of 134 knots.

- During climb, from 15:06:03 UTC to 15:06:38 UTC, the aircraft's speed was maintained between 254 and 270 knots.

- At 15:36:39 UTC, the aircraft reached an altitude of 30,086 feet at a speed of 312 knots, then turned to a heading of 275 degrees while maintaining altitude.
- - At 15:37:00 UTC, after receiving clearance from the country's airspace control center, the aircraft began descending from 30,000 feet to 14,000 feet at a speed of 314 knots.
- - At 15:40:53 UTC, flight IRA277 contacted Urmia Tower and received weather information (ATIS) and airport details for the TUBAR 2A arrival procedure and the VOR/DME ILS approach for runway 21. The crew was informed about the runway condition, including snow and braking action.
- - At 15:44:25 UTC, flight IRA277 reported passing altitude 14,500 feet and subsequently reported reaching 13,000 feet. The tower requested a position report from the flight.
- - At 15:47:53 UTC, flight IRA277 reported its position at 13,000 feet and was cleared for the approach. The controller requested a position report for the Initial Approach Fix (IAF).
- - At 15:50:11 UTC, flight IRA277 reported leaving the IAF and was subsequently requested by the controller to establish on the ILS for runway 21.
- - At 15:54:49 UTC, the tower requested a position report from flight IRA277, and the flight reported its position at 5 miles. The tower then inquired if the flight had established on the ILS, to which the flight responded negatively.
- - The tower asked flight IRA277 if they intended to continue the approach for landing. In response, the flight stated that they had aborted the approach and requested a missed approach. The tower confirmed the missed approach and instructed the flight to rejoin the IAF for runway 21.
- - At 16:00:53 UTC, the tower inquired about the flight's position, and flight IRA277 reported being on standby. The tower then asked about the flight's intentions, and the flight stated they were aborting the approach. Due to intermittent radio communication, the tower requested the flight to repeat their last transmission. Flight IRA277 then stated they were returning to Tehran.
- - At 16:01:46 UTC, the tower informed flight IRA277 that their altitude appeared to be below the minimum allowed.
- - Between 16:02:27 UTC and 16:05:16 UTC, the tower attempted to contact the flight eight times but received no response.

1.2 Injuries to Persons

As a result of the accident and the damages incurred, 78 occupants lost their lives, and 27 were injured.

Injuries	Crew	Passengers	Others	Total
Fatal	8	70	0	78
Serious	1	26	0	27
Minor	0	0	0	0
None	0	0	0	0
Total	9	96	0	105

1.3 Damage to Aircraft

The aircraft was completely destroyed as a result of the accident, and the damages incurred were total.

1.4 Additional Damage

In addition to the aircraft and its occupants, the accident also caused damage to the farmland and orchards of the local villagers.

1.5 Personnel Information

1.5.1 Pilot in Command

The Pilot in Command was a 50-year-old male with ATPL (Airline Transport Pilot License) No. 1753. He began his career as a flight engineer on the B-727, and later served as a co-pilot on the Boeing 747 and the Fokker 100. Eventually, he became the Pilot in Command on the Boeing 727.

His medical examinations were conducted and approved on 26 Khordad 1389 (June 16, 2010), and his medical certificate was valid at the time of the accident.

He participated in a simulator training session on September 15, 2010, which was approved. At the time of the accident, he had a total flight experience of over 7,878 hours, as follows:

- **CPL-INS (Student Pilot):** 197 hours and 35 minutes
- **Flight Engineer on Boeing 727:** 1,235 hours and 25 minutes
- **Co-pilot on Fokker 100:** 810 hours and 30 minutes
- **Co-pilot on Boeing 747:** 1,257 hours and 30 minutes
- **Pilot in Command on Boeing 727:** 2,082 hours and 30 minutes

1.5.2 Co-Pilot

The Co-pilot was a 30-year-old male with CPL/IR (Commercial Pilot License/Instrument Rating) No. 2807. He began his career in the technical and engineering department of the company and later joined the operations department. On 15 Dey 1388 (January 5, 2010), he received his rating for the Boeing 727 aircraft as a co-pilot.

His medical examinations were conducted and approved on 13 Mehr 1389 (October 5, 2010), and his medical certificate was valid at the time of the accident.

He participated in a simulator training session on June 16, 2010, which was approved. At the time of the accident, he had a total flight experience of approximately 600 hours, including basic flight training, as follows:

- **CPL-INS (Student Pilot):** 203 hours and 15 minutes
- **Co-pilot on Boeing 727:** 396 hours and 45 minutes

1.5.3 Flight Engineer

The Flight Engineer was a 55-year-old male with Flight Engineer (FE) License No. 363. He received his flight engineer certification in 1374 (1996/97) and had been flying as a flight engineer on Boeing 727 aircraft. His medical examinations were conducted and approved on 31 Shahrivar 1389 (September 22, 2010), and his medical certificate was valid until 31 Shahrivar 1390 (September 22, 2011).

At the time of the accident, he had a total of 8,332 flight hours as a flight engineer on Boeing 727 aircraft.

1.5.4 Cabin Crew

During the investigation, it was determined that no specific training records were maintained for the cabin crew (flight attendants) at Iran Air. The following information was compiled from letters and documents available in the administrative unit and was prepared by the flight attendant training department. After being reviewed by the operations office, it was submitted to the accident investigation team.

As a result, the retraining records for some courses are available, but the initial training records are incomplete or missing.

- During the investigation, it was also found that the training and operational records for the cockpit crew (Pilot in Command, Co-pilot, and Flight Engineer) were incomplete. Accurate and detailed logbook entries, including stamped pages, were not available in their files.
- Upon reviewing the logbooks of the flight crew involved in this accident and some other cases, it was determined that the crew did not accurately or completely record information in their logbooks. For example, flights conducted under supervision, dual received, or cross-country flights were not properly documented. Additionally, details such as actual instrument hours, simulator hours, landing counts, and locations were not recorded.

1.5.5 Air Traffic Controller

The Air Traffic Controller at Urmia Airport held a valid tower controller license (OITR No. 910) and was certified until 17 September 2014. The license for the Urmia Airport tower controller was issued on 1 Farvardin 1379 (March 21, 2000).

1.5.6 ATC Assistant

The Assistant Air Traffic Controller at Urmia Airport held a valid tower controller license (OITR No. 1331) and was certified until 3 August 2014. The license for the Urmia Airport tower controller was issued on 6 Shahrivar 1388 (August 28, 2009).

1.6 Aircraft Information

- Aircraft Type: Boeing 727-286
- Manufacturer: Boeing Co.
- Aircraft Owner:Islamic Republic of Iran Airlines
- Operator: Islamic Republic of Iran Airlines
- Date of Manufacture: June 1974
- Aircraft Serial Number: 20945
- Aircraft Registration Number: 59220
- Airworthiness Certificate Number and Validity: 59220, valid until December 13, 2011
- Insurance Information: Insured by Iran Insurance Company, Policy No. 3/0011/0367/90000, valid until 29 Dey 1389 (January 19, 2011)
- Total Flight Hours: 53,591 hours
- Total Landing Cycles: 49,353

1.7 Meteorological Information

1.7.1 Destination Airport Weather Information

The weather conditions at Urmia Airport, based on the meteorological report from the Iranian Meteorological Organization dated 19 Dey 1389 (January 9, 2011), are summarized in the table below.

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UTC Time	Wind Direction	Wind Speed	Visibility	Cloud Cover	Temperature	Dew Point	Pressure (hPa)
11:50	250°	04 Knots	800 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	01°C	01°C	1015
12:50	000°	0	700 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	01°C	00°C	1015
13:50	290°	04 Knots	800 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	00°C	00°C	1015
14:50	240°	06 Knots	800 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	00°C	00°C	1015
15:50	260°	04 Knots	800 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	00°C	00°C	1016
16:50	330°	04 Knots	600 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	00°C	00°C	1016
18:00	290°	04 Knots	500 Meters	SCT 1500 ft, SCT 2000 ft, OVC 6000 ft	00°C	00°C	1016

Additionally, the TAF (Terminal Aerodrome Forecast) issued at 06:20 UTC for Urmia Airport, valid from 09:00 UTC to 24:00 UTC, predicts the following conditions:

- Wind: 200° at 4 meters per second, with light mist and cloud cover at 1500 meters.
- Clouds: BKN or OVC at 9000 feet.
- Visibility: 800 meters, expected to decrease due to snow and fog.
- Wind Change: Gradually shifting to 270° at 6 meters per second.
- Visibility Reduction: Visibility will decrease to 800 meters.

Based on the latest report at 16:00 UTC, the weather conditions at Urmia Airport had a visibility of 800 meters, equivalent to at least the minimum visibility required for approach category 21, known as VOR/DME/ILS. Additionally, at the time of the incident, the weather conditions at the airport were reported as cloudy, with freezing temperature conditions.

1.8 Aids to Navigation

1.8.1 Mehrabad International Airport has the following navigation Aids:

- NDB: 380 KHz
- DVOR/DME: 115.300 MHz
- LLZ: 109.900 MHz
- ILSGP: 333.800 MHz
- ILS/DME: CH36X

According to existing documentation, all related systems were functioning normally at the time of the incident.

1.8.2 The Navigation Aids at Urmia Airport are as follows:

- NDB: 370 KHz
- DVOR/DME: 113.500 MHz
- LLZ: 108.900 MHz
- ILSGP: 329.300 MHz
- ILS/DME: CH26X

A flight check of the mentioned systems was conducted on January 10, 2011 at the airport.

1.9 Communication

The communication equipment at Urmia Airport are as follows:

- TWR: 127.2 MHz
- APP: 128.5 MHz

According to the official report from the Flight Operations Department of the National Airports Company, all communication equipment at this airport was operating normally, and no malfunctions were reported at the time of the incident.

Flight IRA 277 from Mehrabad Airport to Urmia Airport continued its flight without any problems until approaching Urmia Airport. Given that the aircraft was on the ILS approach path to Urmia Airport and according to the existing documents, the ILS system was fully operational, the emergency declaration and subsequent monitoring of aircraft movements by the Urmia Airport control tower indicated that the aircraft should have been in a holding pattern. Ultimately, approximately 14 kilometers from the airport, the VOR system signal was lost, and about 10 miles from the airport, the aircraft disappeared from the radar (control center).

Of course, throughout its flight, the aircraft never reported any technical issues, and no emergency message was sent to the Flight Operations and Safety Department.

1.10 Airport Information

Urmia Airport is geographically located at 7NM (approximately 14 km) from the city of Urmia at coordinates N37:40:17-E0:40:50:409. The airport's elevation is 4343 FT above sea level, and its magnetic variation (MAG-VAR) is 4 degrees E. IFR/VFR flights are permitted at this airport.

This airport has a fire and rescue service with a fire protection category of CAT:7.

1.11 Flight Recorders

According to Annex 8 of the Chicago Convention, aircraft weighing more than 5700 kg must be equipped with flight data and voice recording devices (FDR-CVR). Given that this aircraft had a takeoff weight of 50,777 kg, it was equipped with one DFDR and one CVR.

1.11.1 Flight Data Recorder (FDR)

Make: Allied Signal
Type Number: 980-4120-GQUS
Type: 4120 SSFDR
Serial number: 20298
This type of FDR has a magnetic tape with a recording time of 26.6 hours.

1.11.2 Cockpit Voice Recorder (CVR)

Make: Fairchild
Type: CVR
Part Number: A.100
Serial Number: 3185
This type of CVR has a magnetic tape with a recording of about 30 minutes.

The CVR recorded data on 5 tracks as follows:
Track 1: ATC communications 0.5 hour 16 KHz
Track 2: Public address 0.5 hour 8 KHz
Track 3: Cockpit Area Microphone (CAM) 0.5 hour 8 KHz
Track 4: ATIS 0.5 hour 8 KHz

The recorder was located in the rear section of the aircraft, and due to the intact condition of the aircraft's empennage structure, it was found in good condition without damage. Using Red Crescent hydraulic cutting equipment, the device was retrieved and handed over to the investigation team in intact condition.

1.12 Wreckage and Accident Site Information

The crash site was located approximately 194 miles southeast of Urmia Airport at a radial of 150 degrees and at geographic coordinates N37:33.170 and E0:45:09.937, near the villages of Qareh Jeshlu and Meshkinabad.

The aircraft impacted agricultural land near a village, with the collision occurring nose-up. The aircraft fuselage broke into four sections, and debris was scattered across agricultural fields. Important and notable points at the crash site include the following:

The main fuselage of the aircraft was divided into four main sections.
The aircraft impacted the ground in a nose-up position, and the first contact point was the engine exhaust of engine number two

After the aircraft's tail struck the ground, the Left Horizontal Stabilizer hit a tree trunk, causing a severe reduction in the aircraft's speed and leading to its separation.

Engines 1 and 3 were detached from the aircraft's body. Soil and mud were visible on the compressor blades of all 3 engines, indicating movement, but no severe damage or complete failure of the rotating blades was observed. However, damage was evident in Engine 2.

The engine anti-ice valves for Engines 1 and 3 were observed in the open position, indicating the use of the aircraft's de-icing system.

All three landing gears were in the retracted (up) position, suggesting no decision to land was made.

The stabilizer trim angle was in the full nose-up position, and the corresponding lever in the cockpit was in a similar position, indicating that the control systems were responsive.

The aircraft's wings were in the Flap=0 Deg position when they struck the ground.

The power lever for Engine 3 was in the on position.

The cockpit buttons for the anti-ice system, used for de-icing the engines and wings, were in the on position.

1.13 Medical And Pathological Information

After search and rescue operations, the bodies were transferred to the forensic medical center in Urmia, and the injured were taken to designated hospitals in the city based on the ERP (Emergency Response Plan). In response to the investigation team's request, the forensic medical report stated the following:

- 78 individuals died, with most injuries to the head, face and body areas.
- The cause of death for most victims was the aforementioned injuries, and the resulting complications were determined.
- Autopsy and toxicology results for the pilot, co-pilot, and flight engineer were reported, and no specific medical issues that could have contributed to the accident were observed.

1.14 Survival Aspects

The airline, upon not receiving any communication from the flight control of Urmia Airport regarding the status of Flight 277 of the Islamic Republic of Iran and the interruption of radio communications, declared an emergency and readiness. The ground safety officer of the airport was informed of the accident and its location at 19:48 local time via a mobile phone call from a resident of the village of Meshkabad. Immediately, accompanied by the airport director and four ground safety personnel, they rushed to the accident site. To prevent a potential fire, necessary measures were taken with the assistance of a towing vehicle. Subsequently, with the help of village residents, Red Crescent and emergency personnel, and law enforcement forces who were already present at the scene, the survivors were evacuated, and the deceased were transported to hospitals outside the aircraft in Urmia city.

Out of the 105 passengers on board, 78 died and 27 were injured. The injured were admitted to Imam Khomeini (RA), Shahid Motahari, Imam Reza (RA), Shahid Arefian, Army, and Azarbaijan hospitals.

During the transfer of the injured and deceased from the accident site, a total of 35 ambulances and rescue vehicles, along with over a hundred Red Crescent and emergency personnel, collaborated with military and law enforcement forces and local volunteers.

1.15 Witness Statements

Immediately after the accident occurred and the investigation teams were formed, a witness group was also established and dispatched to the accident site to begin their activities. The actions taken included interviewing five witnesses to the accident, who included flight crew, flight attendants, passengers, and local residents near the accident site.

The summary of the witnesses' statements indicates that the weather conditions were unfavorable at the time of the accident, the aircraft was in a missed approach situation and attempted to land again, the cabin power was intermittently cut off, and the aircraft experienced severe turbulence.

The detailed accounts of the above are included in the analysis by the witness group in the second chapter of this report.

1.16 Fire

No fire was observed at the accident site. Upon the aircraft's impact with the ground, the right wing, which contains the fuel tank, was damaged, causing fuel to spill onto the ground. The lower left wing also sustained damage upon impact with the ground, leading to fuel leakage. Fortunately, due to the timely intervention of the firefighting forces, the spread of fire was prevented. The absence of fire at the accident site was also aided by the cold weather and snowfall, which helped in cooling and preventing further damage.

1.17 Tests and Research

To reach a conclusion regarding the accident, the investigation team conducted detailed follow-ups on three key areas:

1. Fuel Testing: Fuel samples were taken from aircraft that were refueled simultaneously at Mehrabad Airport. Necessary tests were conducted to measure the amount of water and contamination in the fuel. The results indicated that the fuel was normal.

2. Engine Testing: Engines 1 and 2 of the aircraft were sent to Tehran for testing. The investigation team aimed to conduct necessary tests at reputable maintenance centers for JT80 engines to analyze the shutdown of these engines during the accident. In coordination with the legal representative of the aircraft manufacturer, the investigation team requested the introduction of accredited centers for this purpose. Centers in countries such as South Africa, Slovenia, and others were recommended. However, only South Africa responded positively to the request, so the engines were sent there for examination. Subsequent investigations revealed that the facilities in this country were similar to those domestically and were capable of performing the required work.

3. Manufacturer Involvement: Due to sanctions imposed on the relevant country, the engine manufacturer (Pratt & Whitney) could not assist directly. Therefore, the investigation team decided to rely on domestic capabilities. After correspondence, the team determined that the facilities and equipment at these domestic centers were suitable for examining the aircraft's engines.

It was sent to the Iranian aviation industries, which had more suitable conditions. This center proceeded with the disassembly of the engine, and until the time of the report's preparation, no defect or issue that could have caused the engine to shut down during flight was found. However, disassembling the internal components of the engine requires special tools, which are currently being manufactured by the aviation industry. After the completion of this process, further disassembly of the internal components, as well as inspection and analysis of these parts, will be carried out to ensure the presence or absence of any technical defect that could have led to the shutdown of engine No. 3.

To simulate this flight, the accident investigation team visited the flight simulation facilities of Iran Air several times. By simulating all possible scenarios of this flight, they conducted a comprehensive analysis of the newly developed flight conditions. Additionally, the FDR and CVR

data of the aircraft were transferred, along with the relevant experts, to the Flight Data Analysis Center of Aseman Airlines. Using the Flight Scape software, this company simulated the final stages of the flight along with audio integration from the aircraft.

1.18 Organizational and Management Information

Iran Air is the national flag carrier of Iran, established in 1946 (1325 in the Iranian calendar). This company currently operates with the support of the Iranian government and benefits from specialized subsidiaries, including HomaTech, HATCO, and in-flight service providers.

Iran Air's fleet consists of Boeing 727, Boeing 747, Airbus A300, Airbus A310, Airbus A320, and Fokker 100 aircraft.

Iran Air's operational strategy involves using short-range aircraft for domestic flights and long-range aircraft for international routes. The company's headquarters is located in Tehran, with other operations managed from domestic and international stations.

Most of Iran Air's international destinations are in Asia and Europe.

The company is managed by the CEO, who also serves as the Deputy Minister of Roads and Urban Development. Following the accident, he, along with the then Minister of Roads and Transportation, quickly traveled to Urmia to provide comfort to the injured and the families of the victims, as well as to oversee search and rescue operations and other emergency response efforts.

1.19 Additional Information

Urmia Airport is located in the northwest of the country. This region is classified as one of the cold areas of Iran. Near this airport, along the approach path, is Lake Urmia. The water vapor rising from the lake's surface, combined with the arrival of Mediterranean air masses, leads to high humidity in the surrounding air. This humidity, along with the cold temperatures of the region, can result in fog formation and ice accumulation on aircraft control surfaces. These conditions require careful attention and heightened awareness from pilots and airlines, necessitating specific planning and precautionary measures.

It is worth mentioning that another accident involving a Falcon 20 aircraft of the Islamic Revolutionary Guard Corps (IRGC), which resulted in the martyrdom of General Kazemi, also occurred in this region. Findings from both incidents should be taken into account to implement necessary precautions for all aircraft.

2 - Analysis

Following the crash of the Iran Air Boeing 727 near Urmia, the Safety and Accident Investigation Office of the Civil Aviation Organization initiated an investigation. The accident investigator, in accordance with CAD.4713, considering the scale and complexity of the investigation, assembled 11 expert teams from different specialties to examine the accident. Due to the extensive and detailed nature of each team's report, their findings and analysis will be presented in sequence.

2.1 Operation Group Report

The accident investigation operations team was dispatched to the crash site on the same night. Initial examinations began, and the team started collecting data, reviewing all relevant documents, panels, flight instruments, engines, control surfaces, and other related components.

On this flight, Captain Fereydoun Dadras was seated as the Pilot Non-Flying (PNF) in the left seat, while First Officer Mohammad Reza Ghareh Tappeh, acting as the Pilot Flying (PF), was seated in the right seat. Morteza Rastkar was positioned as the Flight Engineer (FE) in the engineer's seat.

Geographic Coordinates of Aircraft Parts After the Accident:

The Boeing 727 aircraft, registered as EP-IRP and belonging to Iran Air, was equipped with three engines mounted at the rear of the fuselage. Engines No. 1 and No. 3 were located on either side of the tail, while Engine No. 2, which had a different air intake configuration compared to the other two, was positioned above them.

The main parts of the aircraft were located and mapped using GPS after the accident based on their dispersion. The approximate elevation of the crash site is 4,307 feet MSL.

It should be noted that the fuselage was fragmented into multiple sections but remained relatively aligned. From front to rear, the sections, engines, and other components were arranged as follows:
Cockpit
Section after the cockpit
Second section after the cockpit
Third section after the cockpit:
N 37°33.173 - E 045°09.935
N 37°33.173 - E 045°09.9
N 37°33.170 - E 045°09.937
N 37°33.168 - E 045°09.939

The following sections are identified in the image above:

5. The rear section, located in front of the wings, where the intake of Engine No. 2 was positioned. It was found approximately 1 meter away from the main wreckage at coordinates:
N 37°33.165 - E 045°09.948

Section No. 5 is identified in the image above.

2. Engine No. 3:
N 37°33.160 - E 045°09.957

3. Engine No. 1:
N 37°33.155 - E 045°09.955

Engine Number 2: N 37°33.153 - E 045°09.960
Right Elevator: N 37°33.146 - E 045°09.968

The Tail Cone was placed upside down, and also, in this figure ***

N 37 33.140 - E 045 09.976: LEFT ELEVATOR (10)

This section was located near the first point of impact of the aircraft.

The location of the first impact of the aircraft with a tree in the area around the field where the aircraft was located: (11)

N 37 33.137 - E 045 09.982

It should be noted that the altitude of the Sanjesh site is approximately 4300 feet above sea level.

Operational Investigations

Operation Manual

Based on the CD-ROM containing operational manuals for the Boeing 727 (OM) aircraft, with Revision No: 15, Revision Date: 03 Feb 1992, and Model 727-286.

Included in Bulletin No: 2, Bulletin Date: 20 Nov 1991, section 23.

It should be noted that the Quick Reference Handbook (QRH) checklists were extracted based on the aforementioned dates.

Due to economic sanctions, Iran Air has been unable to receive updated information and modifications regarding operational manuals.

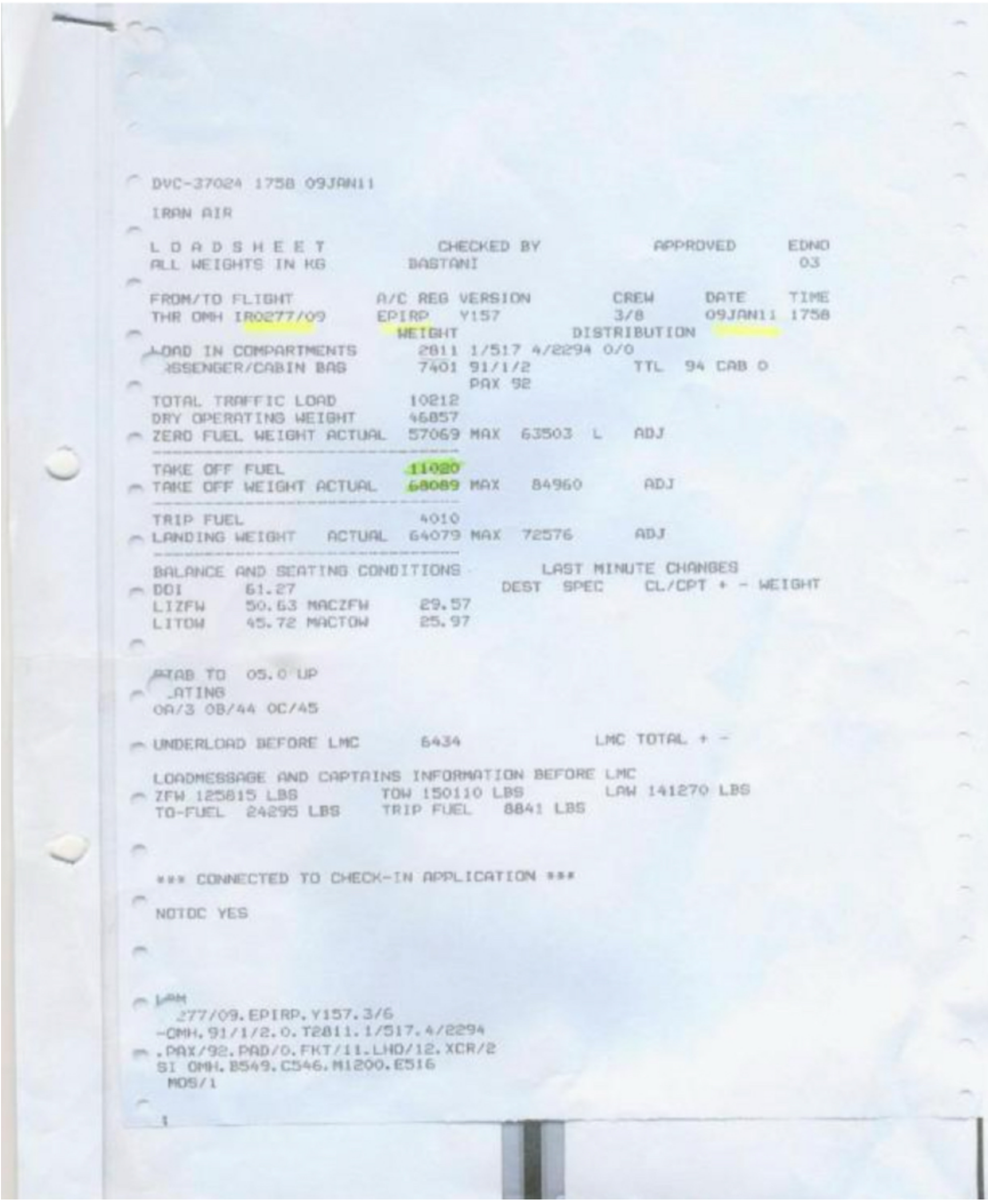
Load Sheet

According to the load sheet, the flight had:
3 cockpit crew members
6 cabin crew members
94 passengers (91 adults, 1 child, and 2 infants)
3 security personnel among the passengers

The actual zero fuel weight was 57,069 kg (125,215 lbs).
The takeoff fuel was 11,020 kg (24,295 lbs).
The aircraft took off with a total weight of 68,089 kg (150,110 lbs) and a center of gravity (CG) of 25.67%.

The maximum allowable takeoff weight for this aircraft was 84,960 kg (150,110 lbs), meaning the aircraft's weight and CG were within permissible limits during takeoff.

The maximum landing weight for this aircraft was 72,576 kg, and the actual landing weight was calculated to be within the allowable range.



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DVC-37024 1758 09JAN11

IRAN AIR

L O A D S H E E T          CHECKED BY          APPROVED     EDNO
ALL WEIGHTS IN KG        BASTANI                             03

FROM/TO FLIGHT        A/C REG VERSION        CREW     DATE     TIME
THR OMH IR0277/09     EPIRP   Y157           3/8      09JAN11  1758
                        WEIGHT              DISTRIBUTION
LOAD IN COMPARTMENTS      2811 1/517 4/2294 0/0
PASSENGER/CABIN BAG       7401 91/1/2          TTL  94 CAB 0
                               PAX 92
TOTAL TRAFFIC LOAD       10212
DRY OPERATING WEIGHT     46857
ZERO FUEL WEIGHT ACTUAL  57069 MAX  63503  L   ADJ
---------------------------------------
TAKE OFF FUEL            11020
TAKE OFF WEIGHT ACTUAL   68089 MAX   84960      ADJ
---------------------------------------
TRIP FUEL                 4010
LANDING WEIGHT   ACTUAL  64079 MAX  72576      ADJ
---------------------------------------
BALANCE AND SEATING CONDITIONS        LAST MINUTE CHANGES
DOI        61.27                  DEST  SPEC    CL/CPT + - WEIGHT
LIZFW      50.63 MACZFW     29.57
LITOW      45.72 MACTOW     25.97

STAB TO  05.0 UP
 _ATING
OA/3 OB/44 OC/45

UNDERLOAD BEFORE LMC      6434             LMC TOTAL + -

LOADMESSAGE AND CAPTAINS INFORMATION BEFORE LMC
ZFW 125815 LBS         TOW 150110 LBS        LAW 141270 LBS
TO-FUEL  24295 LBS     TRIP FUEL   8841 LBS

*** CONNECTED TO CHECK-IN APPLICATION ***

NOTOC YES

LDM
 277/09.EPIRP.Y157.3/6
-OMH.91/1/2.0.T2811.1/517.4/2294
.PAX/92.PAD/0.FKT/11.LHD/12.XCR/2
SI OMH.B549.C546.M1200.E516
 MOS/1
```

ATC Flight Plan Review

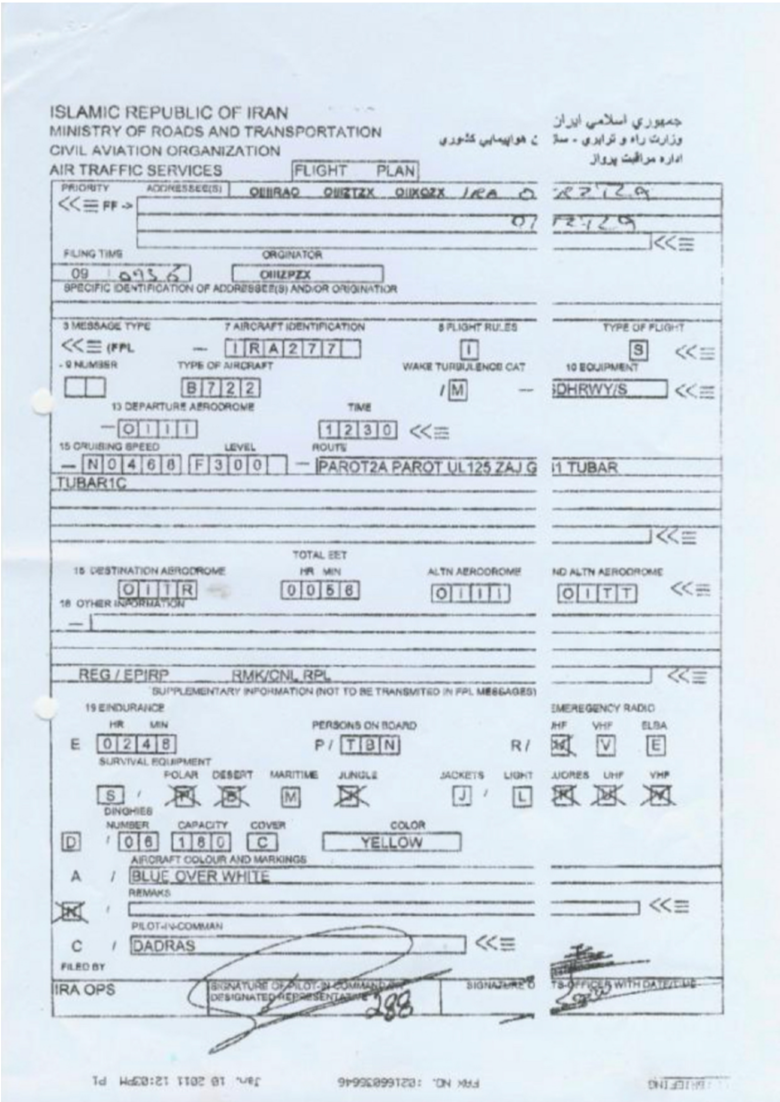
This flight plan is for flight number IRA-277 using a B.727 aircraft model. The flight is scheduled as an IFR (Instrument Flight Rules) flight with Wake Turbulence category set to Medium. The aircraft is equipped with Standard COM/NAV/Approach AID Equipment, DME, HF RTF, RNP Type, and Transponder Mode S.

The origin of the flight is Mehrabad Airport in Tehran, and the destination is Urmia Airport. The alternate airports are Mehrabad Airport in Tehran and Tabriz Airport.

The estimated flight time is 56 minutes at a speed of 366 knots, with a cruising altitude of 30,000 feet. The flight route is defined as follows:

PAROT 3A PAROT UL 125 ZAJ G781 TUBAR TUBAR 2A

Based on the aircraft's fuel capacity, the maximum flight duration (Endurance) is determined to be three hours and five minutes.


ISLAMIC REPUBLIC OF IRAN
MINISTRY OF ROADS AND TRANSPORTATION
CIVIL AVIATION ORGANIZATION
AIR TRAFFIC SERVICES

جمهوري اسلامي ايران
وزارت راه و ترابري - سا ... ن هواپيمايي كشوري
اداره مراقبت پرواز

FLIGHT PLAN

PRIORITY ADDRESSEE(S) OIIIRAO OIIZTZX OIIKOZX IRA O
<<≡ FF ->

FILING TIME 09 0936
ORGINATOR OIIZPZX

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATIOR

3 MESSAGE TYPE <<≡ (FPL
7 AIRCRAFT IDENTIFICATION — IRA277
8 FLIGHT RULES I
TYPE OF FLIGHT S <<≡

9 NUMBER
TYPE OF AIRCRAFT B722
WAKE TURBULENCE CAT / M
10 EQUIPMENT — SDHRWY/S <<≡

13 DEPARTURE AERODROME — OIII
TIME 1230 <<≡

15 CRUISING SPEED — N0468
LEVEL F300
ROUTE — PAROT2A PAROT UL125 ZAJ G 1 TUBAR
TUBAR1C
<<≡

16 DESTINATION AERODROME OITR
TOTAL EET HR MIN 0056
ALTN AERODROME OIII
2ND ALTN AERODROME OITT <<≡

18 OTHER INFORMATION
—
REG / EPIRP RMK/CNL RPL <<≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITED IN FPL MESSAGES)

19 ENDURANCE HR MIN E 0248
PERSONS ON BOARD P / TBN
EMERGENCY RADIO UHF VHF ELBA R / U V E

SURVIVAL EQUIPMENT POLAR DESERT MARITIME JUNGLE S / P D M J
JACKETS LIGHT FLUORES UHF VHF J / L F U V

DINGHIES NUMBER CAPACITY COVER COLOR D / 06 180 C YELLOW

AIRCRAFT COLOUR AND MARKINGS A / BLUE OVER WHITE

REMAKS N /
<<≡

PILOT-IN-COMMAN C / DADRAS <<≡

FILED BY IRA OPS
SIGNATURE OF PILOT-IN-COMMAND OR DESIGNATED REPRESENTATIVE 288
SIGNATURE OF ATS-OFFICER WITH DATE/TIME

Jan. 18 2011 12:03PM P1 FAX NO. :02166036646 BRIEFING

The flight plan was set to start at 12:30 UTC. However, due to the delay in executing this flight, another flight plan with the same specifications and an estimated flight time of 57 minutes was prepared again, with a new start time of 14:45 UTC.

The reason for this delay was an issue with the aircraft's GPS and adverse weather conditions at Urmia Airport. Before the flight, the GPS issue was resolved by replacing a component, and after reapproval by the technical personnel, the aircraft was cleared for departure.

An image of this document (OP1) is included on the next page.

Iran Air
The Airline of the Islamic Republic of Iran

ET AIRCRAFT TECHNICAL FLIGHT LOG

PAGE NO. 071

A/C Reg. EP- IRP | Flt. No. 77 | Date 09.01.11 | Capt. DADRAS | F/E RASTEGAR

Station From	To	Time Take off	Landing	Gross Weight T.O.	Landing	Fuel T.O.	Landing	Added	Unit	Oil 1	2	3	4
THR						16500		6800	LTS				

TOTALS

Type of Maint. Check Accomp.: TRANSIT
Date: JUN. 09. 2011 Station: THR
Airworthiness Release
Insp./Engr. Stamp/Lic. No. A.174

Discrepancies & Comments	Item	Station	Action Taken by Maintenance	Inspector/Mech. Sign.
DURING PRE FLT CHECK FOUND G.P.S IS I.OP	1	THR	G.P.S CONT PNL CHANGED CK) O.K.	
	X	THR	REF TO B/S ITEM # 83 ... ABOUT AFT A.R.DIM DOWN LOT CK) SW CONN CLEANED & SECURED CKD O.K.	

Item	Position	Component Replaced	Part Number	S/N off	S/N On	Position	Post/Loan
1	IR	GPS CONT PNL	... 62-241 A	... 226	2417...		IR

Preflight Completed F/E
Aircraft Accepted Capt.
Certified Correct Capt.

Form No. 930 ...

Computed Flight Plan

According to this flight plan, which was obtained from SITA, this flight was scheduled for January 9, 2011, for a Boeing 727-200 with the registration EP-IRP. The departure airport was Mehrabad Airport in Tehran, and the destination was Urmia Airport. The flight route was as follows:

OIII PARO 3A PAROT UL 125 ZAJ G781 TUBAR TUBA 2A OITR

The estimated time of departure was set for 12:30 UTC, with a flight duration estimated at 56 minutes.

The trip fuel consumption for this flight was calculated to be 8,846 lbs, and the total fuel amount was 25,000 lbs. The minimum fuel required to reach the first alternate airport (Mehrabad) was specified.

The designated alternate airports, in order, were Mehrabad, Tabriz, and Isfahan. This flight plan was valid until 18:30 UTC on the same day (for a duration of six hours).

The information contained in this flight plan is correct.

An image of this flight plan is shown on the next page.

```
CFP INPUT MESSAGE DATE TIME REF 090629
START OF CFP REF : DYS87  -  IRA277  01 THR  OMH

////IRA RNAV ROUTE\\\\
PLAN DYS87 IRA277      OIII TO OITR  B727-2  M80/F  IFR 09/01/11 LBS
NONSTOP COMPUTED 0629Z FOR ETD 1230Z REG- IRP  PROGS 090000Z
PLAN VALID FOR DEPTR UNTIL 1830Z 09/01/11                  REF DYS87

            FUEL   TIME  DIST ARRIVE TAKEOFF  LNDG    PLD   OPNLWT
DEST OITR 008846 00.56 0334  1326Z  144240 135397 017000 102943
ALTN THR  008119 00.56 0351
HLD       003897 00.30
RES       000442 00.03
TXY       000700
REQUIRED  022004 02.25
XTR       002996 00.23 TRK THROMH02
ADDITION  000000 00.00 DUE .. .. .. .. .. .. .. .. ..
TOTAL     025000 02.48 FUEL INCLUDES 00 PCT PERF FACTOR

BURN OFF ADJUSTMENT FOR  1000  LBS INCREASE IN TAKEOFF WT 00035 LBS
HEIGHT CHANGE 2000FT BELOW ASSIGNED FLIGHT LEVEL  ADD 00204 LBS

OIII PARO3A PAROT UL125 ZAJ G781 TUBAR TUBA2A OITR

WIND M025   MXSH 03/PAROT   TEMP M06  NAM 0357
FL 300

             DIST   FL   W/C   TIME  FUEL     MOD
ALT 1  OIII  0351  290  P017  00.56  8119   12016
ALT 2  OITT  0072  130  M003  00.18  2978    6875
ALT 3  OIFM  0489  290  P012  01.16 10690   14587

CLEARANCE: .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. ..

OIII ELEV  03962FT
                                                   SCHD DEP: 1230
                                                   OFF BLK :
                                                   TAKE OFF:

CPT    FL  SOT     TAS WIND  COMP  AW      ZT   ZD   ETO   ATO    REM
FREQ   MORA                        MT.     CT   CD   RETO  DI

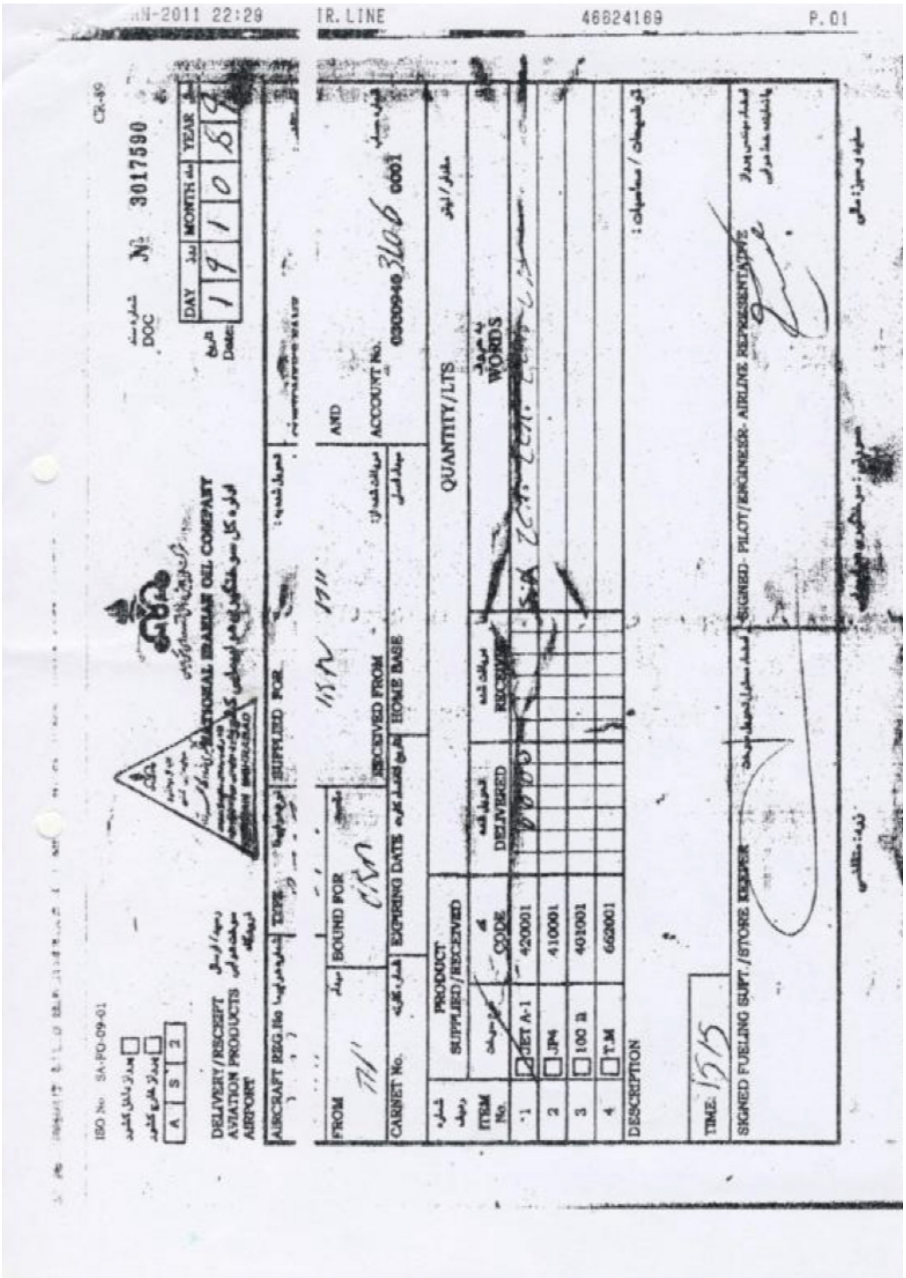
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
OIII        .. ..      ....    ..         0.00 000  ....  .... 000000
       000 N3541.3 E05118.9        000    0.00 0000 ....  .... 024300
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
12TRN  CLB .. ..  364 ....     ..  PARO3A 0.02 015  ....  .... 000861
       153 N3542.6 E05102.3        271    0.02 0015 ....  .... 023439
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
TOC    300 00M49  364 23073 M019   PARO3A 0.11 058  ....  .... 003145
       176 N3611.0 E04959.8        294    0.13 0073 ....  .... 020294
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
PAROT  300 03M49  468 23073 M043   PARO3A 0.01 004  ....  .... 000034
       176 N3611.5 E04958.7        294    0.14 0077 ....  .... 020260
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
ZAJ    300 03M51  466 23067 M036   UL125  0.12 086  ....  .... 001777
114.40 176 N3646.8 E04821.2        290    0.26 0163 ....  .... 018483
-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
TOD    300 00M51  465 23050 M029   G781   0.11 081  ....  .... 001645
       145 N3706.5 E04643.3        279    0.37 0244 ....  .... 016838
```

Fueling Report:

The fueling report numbered 3017590, dated January 9th 2011, indicates that the flight originated from Tehran and was destined for Urmia. The type of fuel used was JET A-1 with code 420001, and the aircraft was fueled with 6000 liters for the Tehran-Urmia flight at 15:15.

In this review, it was determined that Iran Air (the airline of the Islamic Republic of Iran) does not provide pilots with a copy of the fueling report that specifies the amount and type of fuel.

Therefore, Safety Directive No. AIG359, dated March 4th 2011, was issued regarding this matter.



(Automatic Terminal Information Service) ATIS
Information B (Time: 13:04:00 UTC):
Runway 21 for arrival, Runway 03 for departure
Expect VOR/DME/ILS approach for Runway 21
Transition Level: 110
Wind: Calm
Visibility: 700 meters
Weather: Snow
Scattered clouds at 1,500 ft, scattered clouds at 2,000 ft, overcast clouds at 6,000 ft
Temperature: 01Â°C, Dew Point: 00Â°C
QNH: 1015
On first contact with tower/approach, notify receipt of Information B.
Information C (Time: 14:02:00 UTC):
Runway 21 for arrival, Runway 03 for departure
Expect VOR/DME/ILS approach for Runway 21
Transition Level: 110
Wind: 290Â° at 4 knots
Visibility: 800 meters
Weather: Heavy snow
Scattered clouds at 1,500 ft, scattered clouds at 2,000 ft, overcast clouds at 6,000 ft
Temperature: 00Â°C, Dew Point: 00Â°C
QNH: 1015
On first contact with tower/approach, notify receipt of Information C.

Final ATIS heard on the CVR before the accident:
Information D (Time: 15:25:00 UTC):
Runway 21 for arrival, Runway 03 for departure
Expect VOR/DME/ILS approach for Runway 21
Transition Level: 110
Wind: 240Â° at 6 knots
Visibility: 800 meters
Weather: Heavy snow
Scattered clouds at 1,500 ft, scattered clouds at 2,000 ft, overcast clouds at 6,000 ft
QNH: 1015
On first contact with tower/approach, notify receipt of Information D.

Notes:
The ATIS information recorded on the CVR at 15:38:42 UTC does not include runway conditions or braking action reports.
Despite the heavy snowfall, the ATIS had not yet been updated to reflect this.
In ATIS Information F, this issue was corrected, but the timestamp was still listed as 15:25:00 UTC, which was inaccurate.
At 15:41:17 UTC, the Urmia Tower Controller provided the latest runway surface condition report to the aircraft.
The pilot read back the information. However, this discrepancy had no impact on the accident.
According to ATIS D, the lowest cloud layer was overcast at 6,000 feet.
Therefore, if the aircraft had been flying correctly below this altitude, the pilots should have been able to see the runway.

Information F Time 15:25:00

RWY 21 for arrival, braking action medium slush. RWY 03 for departure, braking action medium slush. Expect VOR/DME/ILS approach for Runway 21. Transition Level 110, wind 240° at 6 knots, visibility 800 meters, weather: heavy snow. Scattered clouds at 1,500 ft, scattered clouds at 2,000 ft, overcast clouds at 6,000 ft. Temperature 0°C, dew point 0°C, QNH 1015. First contact with tower/approach, notify receipt of Information F.

Information G Time 18:31:00

RWY 21 for arrival, braking action medium slush. RWY 03 for departure, braking action medium slush. Expect VOR/DME/ILS approach for Runway 21. Transition Level 110, wind 290° at 4 knots, visibility 500 meters, weather: heavy snow. Scattered clouds at 1,500 ft, overcast clouds at 6,000 ft. Temperature 0°C, dew point 0°C, QNH 1016. First contact with tower/approach, notify receipt of Information G.

Weather report analysis:

Based on the meteorological report, it appears that METAR was issued at 16:01:08 UTC. The weather conditions at 15:50:00 UTC and 16:50:00 UTC are as follows:

15:50:00 UTC
Wind: 260° at 4 knots
Visibility: 800 meters
Weather: Heavy snow
Clouds: Scattered at 1,500 ft, scattered at 2,000 ft, overcast at 6,000 ft
QNH: 1018 hPa

16:50:00 UTC
Wind: 330° at 4 knots
Visibility: 600 meters
Weather: Heavy snow
Clouds: Scattered at 1,500 ft, scattered at 2,000 ft, overcast at 6,000 ft
QNH: 1018 hPa

Additionally, AIRMET 12 (weather warnings for flight operations) was valid from 13:05 UTC to 14:30 UTC, and AIRMET 13 was valid from 14:30 UTC onwards. These warnings indicated a reduction in visibility due to snow, ice, and airborne particles, with visibility dropping to 800 meters and in some cases reaching as low as 300 meters.

Given that the aircraft was cleared to land at 15:02:02 UTC, it was expected that flight operations would continue under the prevailing conditions.

According to the initial report from the Urmia Airport meteorological team and national weather reports, the weather conditions in the northern part of the country were reported to be unstable.

There was no freezing rain or freezing drizzle. Based on the latest meteorological report and considering the type of clouds and snowfall, the intensity of icing was likely between light and at most moderate.

Analysis of Flight Operations, Arrival Procedures, Approach, and Missed Approach

(Star, Approach & Missed Approach Charts)

Based on the investigations conducted regarding compliance with flight operation standards, and according to the information provided by the Aeronautical Information unit and the Airway Manual, the aircraft's approach was performed in compliance with established regulations. Given that the visibility at Urmia Airport was 800 meters and the navigation systems were functioning properly, the captain was authorized to conduct the approach while adhering to the specified limitations in the manual.

Notes:

- According to the CVR recordings, the first officer was piloting the aircraft under the captain's supervision.
- At 15:54:53 UTC (approximately six miles from the airport), the captain took over as Pilot Flying and assumed full control of the aircraft.
- The total duration of the CVR recording is 31 minutes and 37 seconds.
- The flight duration from takeoff until the start of the CVR recording was 33 minutes and 35 seconds.
- The time elapsed between the aircraft reaching FL 300 (Flight Level 300) and the start of the CVR recording was 11 minutes and 21 seconds.
- The cockpit crew received airport information 8 minutes and 30 seconds after the start of the CVR recording via the Automatic Terminal Information Service (ATIS).
- However, the CVR does not contain any audible evidence of a cockpit briefing related to the arrival procedure, approach plan, minimums, weather conditions, or other relevant details.

Recorded Conversation:

The only statements made by the captain at the specified time were:

"We are here. Let me tell you… Runway…

153724… 07:11… PIC… 209, let me tell you, set this to seventy… seventy… seventy, then that one to two hundred forty, our arc is eleven. See, from here, when you cross this radial, do you want to continue on the same heading or adjust it here?"

At 15:36:48 UTC, based on the information recorded in the CVR & FDR, the captain decides to initiate descent 95 nautical miles from Urmia Airport.

Time	Speaker	Statement
15:36:48 UTC	PIC	Shall we descend at 95?
15:36:50 UTC	PIC	95, shall we descend?
15:35:51 UTC	FO	Yes, sir, we'll take the 95 (probably referring to 95 nautical miles from Urmia Airport for the descent request).

Since the aircraft reached TUBAR at FL 130, the minimum altitude required for the G781 flight route, the captain was obliged to maintain that altitude. However, he initiated a descent before reaching the 20 nautical mile point within the airport's s TMA zone. The information on the navigation chart indicates that the aircraft should have reached 95 nautical miles from ROVON, where the G781 route requires an altitude of 13,000 feet. However, at TUBAR, the aircraft was still at 12,839 feet.

At 15:37:15 UTC, the flight control center (ACC) permitted the aircraft to descend from FL 300 to 14,000 feet. During this phase, the PF (Pilot Flying) performed a three-stage engine throttle reduction for descent, decreasing power smoothly. At 15:47:28 UTC, the captain instructed the first officer to read the Descend-Approach Checklist.

During this descent phase, the aircraft's altitude was 30,086 feet, the speed was 312 knots, the pitch was 1.0 degrees UP, and the vertical acceleration was 0.99g, with a thrust setting (EPR) of 1.274. The longitudinal acceleration of engines 1, 2, and 3 was recorded as 1.85, 1.86, and 1.86, respectively, with an acceleration value of 0.11 degrees.

At 15:37:59 UTC, the captain states:
One would think we are not descending at all continue in the same direction and enter ARC 11 DME

15:37:57 UTC	7:44	PIC	I will wait…. Or not… or not.
15:37:59 UTC	7:46	PIC	Just continue with the same heading.
15:38:03 UTC	7:50	PIC	If I continue, it will automatically reach eleven.

At 15:38:42 UTC, the pilots received the ATIS (Automatic Terminal Information Service) information for Urmia Airport via frequency, as follows:

15:38:42 UTC	8:30	ATIS	Information D Time 15:25:00: RWY 21 for arrival, RWY 03 for departure, expect VOR/ DME/ILS approach for Runway 21, Transition Level 110, Wind 240° at 6 knots, Visibility 800 meters, Weather: heavy snow, Scattered clouds at 1500 ft, Scattered clouds at 2000 ft, Overcast clouds at 6000 ft, QNH 1015. First contact with tower/ approach, notify receive D.

- At 15:38:50 UTC, the altitude was 29,980 ft, speed was 314 KT, pitch was -0.3 degrees, vertical acceleration was 0.97g, heading was 275 degrees, and the turn rate was 0 degrees. The EPR (Engine Pressure Ratio) for engines 1, 2, and 3 was 1.82, 1.84, and 1.78, respectively, and the longitudinal acceleration was 0.10 degrees. From this moment onward, the engines were reduced to idle power.

- At 15:39:46 UTC, the altitude was 26,377 ft, speed was 313 KT, pitch was -1.7 degrees, vertical acceleration was 0.99g, heading was 276 degrees, and the turn rate was -1 degree to the left. The EPR for engines 1, 2, and 3 was 1.20, 1.19, and 1.14, respectively, and the longitudinal acceleration was 0.06 degrees.

- At 15:40:52 UTC, the altitude was 25,967 ft, speed was 312 KT, pitch was -2.1 degrees, vertical acceleration was 1.01g, heading was 273 degrees, and the turn rate was 1 degree. The EPR for engines 1, 2, and 3 was 1.07, 1.12, and 1.06, respectively, and the longitudinal acceleration was 0.06 degrees.

- At 15:40:56 UTC, the altitude was 25,800 ft, speed was 312 KT, pitch was -2.1 degrees, vertical acceleration was 0.99g, heading was 273 degrees, and the turn rate was 1 degree.

The EPR (Engine Pressure Ratio) for engines 1, 2, and 3 was 1.06, 1.08, and 1.06, respectively, and the heading was 273 degrees. The longitudinal acceleration was 0.06 degrees. At this time, the engines were at idle power or slightly above.

At 15:41:05 UTC, the first officer contacted Urmia Tower and reported that they were at 63 DME (Distance Measuring Equipment) from the airport. They mistakenly stated that they were leaving FL 250 for FL 140, and that they had been released by Tehran Control. However, they had not yet been released by Tehran Control, and this was only done at 15:44:11 UTC.

At this time, the altitude was 25,440 ft, the speed was 313 KT, the pitch was -2.2 degrees down, the vertical acceleration was 0.99g, the heading was 273 degrees, and the turn rate was 0 degrees. The EPR for engines 1, 2, and 3 was 1.06, 1.06, and 1.06, respectively, and the longitudinal acceleration was 0.05 degrees. At this time, the engines were near idle power.

15:41:05 UTC	10:52	PIC	Sir, 63 DME , Out of 250 Released by Tehran, B, 10 …………… 15 IRA 277.

At 15:44:10 UTC, the pilot ordered the speed brakes, which had been open until now, to be retracted.

15:44:10 UTC	14:24	PIC	Retract the speed brakes.

(The speed brakes were used to reduce altitude and speed more quickly.)

At this time, the Air Traffic Control Center (Unit 5) handed over flight monitoring to Urmia ATC on frequency 118.25.

15:44:19 UTC	13:58	ACC	IRA 277, Radar Service terminated, continue with Urmia frequency, 118.25. Happy landing, good day.

The map on the next page displays the flight route of G781 towards Urmia Airport's CTR on the En-Route Chart.

At UTC 15:45:13 – Altitude: 13,409 feet, Speed: 291 knots, Pitch: -1.2 degrees (Pitch Down)

- Vertical Acceleration: 0.99
- Heading: 297 degrees
- EPR (Engine Pressure Ratio) for engines 1, 2, and 3: 1.05, 1.06, 1.05
- Longitudinal acceleration: unspecified value in degrees

(Longitudinal Acceleration) is +0.06 degrees. The engines are also near Idle Power.

At this moment, the Pilot in Command (PIC) gives the command Anti-Ice: Open. The flight engineer also turns on the switches and checks the system's functionality. This is evident from the extracted CVR statements below:

In this section of the recording, there is a possibility that the Continuous Ignition Switch, which has a protective cover, was unintentionally activated. Following this, three switches for Engine Anti-Ice were turned on, accompanied by three distinct “tic” sounds. Their function was verified using the Valve Selector, and they were confirmed to be in the correct position.

15:45:13 UTC	15:00	PIC	Anti-Ice open please.
15:45:15 UTC	15:02	-	*Clicking sounds* *tic tic tic… weaker… tic tic tic… even weaker*
15:45:19 UTC	15:06	FE	Anti-Ice on.
15:45:24 UTC	15:11	FE	Holding at 55. (Referring to N1 percentage)
15:45:27 UTC	15:14	PIC	My dear yes, we do have that. (?)

The sequence of sounds—“tic weak, tic weaker, tic even weaker”—is associated with this process.

As stated in the Flight Manual, the ignition system must be activated before turning on the anti-ice system. Therefore, the Continuous Ignition switch should not have been turned on afterward. Typically, this switch remains off, but if the protective cover on the Overhead Panel was accidentally struck, it could have led to the switch being activated.

It is possible that the described sequence of sounds resulted from accidental activation due to a strike on the overhead panel.

Supplementary Procedures - Adverse Weather

In the Flight Manual, section 04.17.01, it is stated that when the flight requires Engine Anti-Ice, the following procedure must be performed:

1. Continuous Ignition: ON
2. Anti-Ice Valve Position Selector: L
3. Check anti-ice valve switches: OPEN
4. Check that all left anti-ice valve position lights extinguish and re-illuminate.
5. Anti-Ice Valve Position Selector: COWL THEN R
6. Continuous Ignition: OFF

Once the engine operation is stabilized and other flight conditions permit, the continuous ignition should be turned OFF.

In the Flight Manual, section 04.25.15, it is also stated that an appropriate thrust setting should be used to increase the engine safety margin during icing conditions.

To increase engine speed, the Thrust Setting should be increased and maintained for a prolonged duration within the Lower Thrust Range.
In conditions of Moderate & Severe icing, the aircraft should be flown at a higher thrust setting to maintain sufficient heat, ensuring proper Engine Anti-Icing.

Definitions:

- DE-ICE: A system designed to remove existing ice formation from surfaces.
- ANTI-ICE: A system designed to prevent ice formation before it occurs.

The above diagram illustrates the status of the Continuous Ignition and Engine Start Switches after the accident.

The systems investigation team of the accident review committee has explained the cause and mechanism of the POP OUT of the circuit breakers (CBs) in their report. The diagram below also highlights these CBs.

Another significant point in the recorded conversations is that N1 was maintained at 55%. However, at this time and afterward, based on the EPR readings shown in the FDR graph, the engines remained in Idle Power mode.

EPR is present, but N1 is maintained at 55%. This raises questions as to why the engineer mentions Idle Power. Did the engineer make an error, or did the engine not respond appropriately, and the engineer also did not pay attention?

From the time 15:40:50 UTC, the EPR values for engines 2 and 3 were around 1.06 or slightly higher. This value remained constant until 15:47:00 UTC, during which the engine speed (N1) was maintained at 55%, which is less than expected.

Therefore, to ascertain the truth, the operations and engine teams requested a flight test of the aircraft. The flight was conducted on June 25th 2011, and many aspects were evaluated and analyzed. Each issue will be discussed in its appropriate context. However, due to the Missed Approach condition and the presence of passengers, a thorough investigation was not possible.

During this analysis, it was found that when the engine speed (N1) is low, the EPR values decrease. When the engines are at Idle Power with N1 at 55%, the EPR values are around 1.08, but no significant change in EPR is observed. In this situation, the captain was asked to turn on the Engine Anti-Ice, but no noticeable change in EPR was observed. Subsequently, the captain was asked to turn on the Wing Anti-Ice, but again, no significant change in EPR was observed.

Note: It was concluded that the flight engineer indeed maintained N1 at 55%, but no change was observed in the related EPR values. In this aircraft, the initial increase or decrease in engine power is controlled by the Pilot Flying (PF), while monitoring and fine-tuning the engine power based on weight, temperature, altitude, and other flight conditions is the responsibility of the Pilot Non-Flying (PNF), with assistance from the flight engineer.

It is worth mentioning that this aircraft uses an Anti-Ice system for the engines and wings.

At 15:47:01 UTC, the altitude was 12,819 feet, speed was 226 knots, pitch was -2.8 degrees (Pitch Up), vertical acceleration was 0.95, heading was 297 degrees, and the longitudinal acceleration was +0.15 degrees. The EPR values for engines 1, 2, and 3 were 1.22, 1.26, and 1.26, respectively.

By 15:48:18 UTC, the engine power (EPR) had slightly increased.

Supplementary Procedures Page 04-17 - Operations Manual: Based on the point raised, when weather conditions are such that icing or the possibility of icing exists, the Anti-Ice system must be ready (On) throughout ground movement or flight, especially when the Saturated Air Temperature (SAT) is less than -40°C during climb and cruise. This is because at temperatures below -40°C SAT, ice does not adhere to the aircraft's body or other airframe parts.

Note: When entering icing conditions during flight, the N1 RPM should be maintained at a minimum of 55%. If moderate or severe icing is present at a True Air Temperature (TAT) of less than -6.5°C, the N1 RPM of the engines should not be less than 70% for landing.

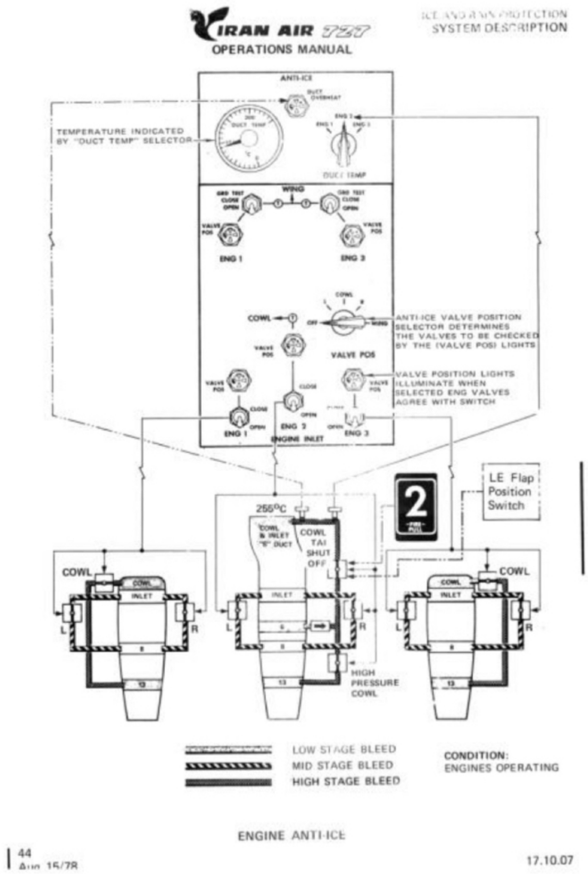
It is also mentioned on the same page that caution should be exercised, and the anti-ice system should not be used at temperatures above 10°C TAT.

Ice & Rain Protection - Limitation Section in the Flight Manual:** It is noted that in light icing conditions, the N1 of the engines should not be less than 65%, and in moderate to severe icing conditions, the N1 should not be less than 70% when the TAT is below -6.5°C.

Additionally, erratic or abnormal EPR (Engine Pressure Ratio) compared to N1 RPM may indicate engine icing.

Note: According to the Flight Manual, Section Ice & Rain Protection - Page 20, when the Anti-Ice switches related to the engines are opened, the Anti-Ice Valves open. These valves provide warm air to the Inlet Guide Vanes and Nose Dome on both the left and right sides. The Cowl Valve also supplies sufficient warm air to the cowl. The next image shows the Anti-Ice system of this aircraft's engine.

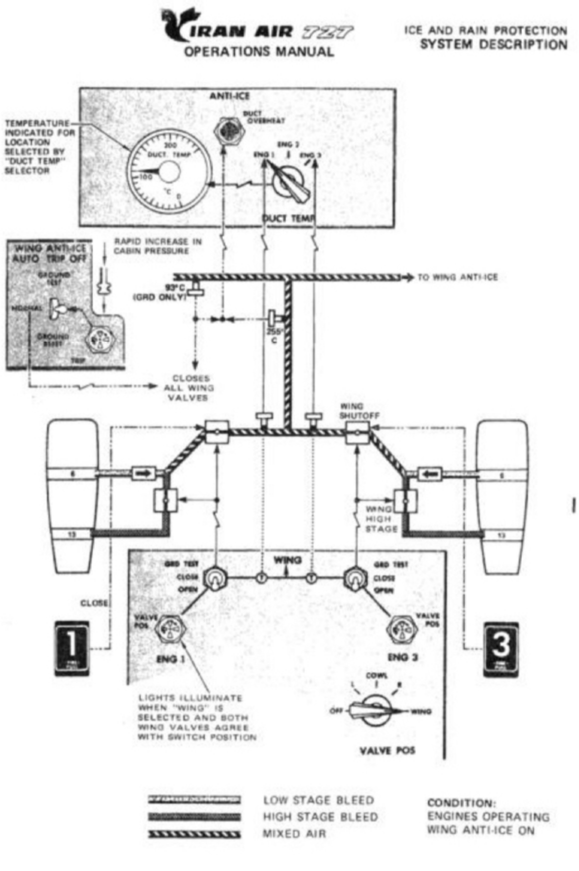
Wing Anti-Ice & Rain Protection - Page 24, Section 2 of the Flight Manual: Based on the Flight Manual, warm bleed air from engines number 1 and 3 is used for wing anti-icing. This warm bleed air is directed through the Shut Off Valve and High Stage Valve of the respective engine to the manifold on one side.



If the engine power is reduced excessively in conditions where icing is likely, this will result in insufficient warm bleed air being sent to the leading edge, antennas, and other necessary parts, despite the anti-ice systems being activated. This increases the risk of ice formation.

Additionally, pulling the engine fire switch will also close the Engine Wing Shut Off Valve.

The next image shows the Wing Anti-Ice system of this aircraft.



WING ANTI-ICE

The next image also shows the aforementioned switches after the occurrence of the accident:

At 15:47:28 UTC, the altitude was 12,819 feet, the speed was 228 knots, and the pitch was -3.2 degrees up. The aircraft's heading was 297 degrees, the turn rate was 0 degrees, and the vertical acceleration was 0.98 G.

ANTI-ICE DUCT TEMPERATURE INDICATOR

– Temperature indication as determined by duct temperature selector.

WING ANTI-ICE SWITCH

GRD TEST – Spring loaded to close. Opens wing anti-ice valves on ground for test.

OPEN – Opens wing anti-ice valves in flight.

WING ANTI-ICE VALVE POSITION LIGHT (Green)

ILLUMINATED
– Both wing anti-ice valves in Engine 1 agree with the Eng 1 wing anti-ice switch position.

TEMPERATURE SYMBOL

Location of Eng 1 and Eng 3 wing anti-ice supply duct temperature sensors.

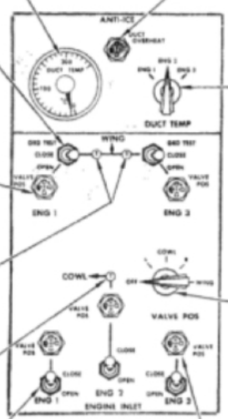
TEMPERATURE SYMBOL

Location of Eng 2 cowl anti-ice duct temperature and overheat sensors.

ENGINE INLET ANTI-ICE SWITCHES

OPEN – Opens all engine anti-ice valves for respective engine.

3 VALVES



OVERHEAD PANEL

ANTI-ICE DUCT OVERHEAT LIGHT (Amber)

ILLUMINATED –
– Excessive temperature in left or right wing anti-ice supply, or duct.
– Engine 2 cowl duct.
– Independent of duct temperature selection.

ANTI-ICE DUCT TEMPERATURE SELECTOR

Determines source of temperature displayed by duct temp indicator.

ENG 1 – Wing anti-ice left supply duct temperature.

ENG 2 – Engine 2 cowl duct temperature.

ENG 3 – Wing anti-ice right supply duct temperature.

ANTI-ICE VALVE POSITION LIGHT SELECTOR

Selects valves to be checked by the valve position lights.

L – Left inlet valves; Engines 1, 2, and 3.

COWL – Cowl Valve; Engines 1 and 3 – Cowl shutoff valve and high pressure valve; Engine 2

R – Right inlet valves; Engines 1, 2, and 3.

WING – Both wing shutoff valves and both wing high stage valves.

ENGINE INLET ANTI-ICE VALVE POSITION LIGHTS (Green)

ILLUMINATED
– Valve position agrees with switch position.

The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.38, 1.40, and 1.35, respectively, and the longitudinal acceleration was +0.18 G.

Based on the First Officer's instructions, the flight engineer began reading the Descent-Approach Check List.

15:47:28 UTC	17:15	PIC	Descend and Approach Checklist

It is necessary to mention that the operation of the Anti-Ice system was checked and confirmed by all three crew members according to the CVR (Cockpit Voice Recorder):

15:47:30 UTC	17:17	FE	Anti-Ice?
15:47:32 UTC	17:19	FO	Open
15:47:33 UTC	17:20	FE	Landing Light?
15:47:34 UTC	17:21	FO	On

The relevant checklist from the QRH (Quick Reference Handbook) was followed.

DESCENT-APPROACH

Seat Belt	ON	F/E
Anti-Ice	CLOSE/OPEN	C,F/O
Landing Lights	ON	F/O
Altimeters	SET & X-CHECKED	ALL
Radio Altimeter	SET	C,F/O
Flight Instruments, FDS and Radios	SET & X-CHECKED	C,F/O
Go-Around EPR & V_{Ref}	BUGS SET	ALL
Fuel	SET FOR LANDING	F/E
Hydraulics	PRESS & QTYS NORMAL	F/E
Pressurization & Cooling Doors	SET	F/E
Circuit Breakers	CHECKED	F/E
Descent-Approach Checklist	COMPLETE	F/E

LANDING

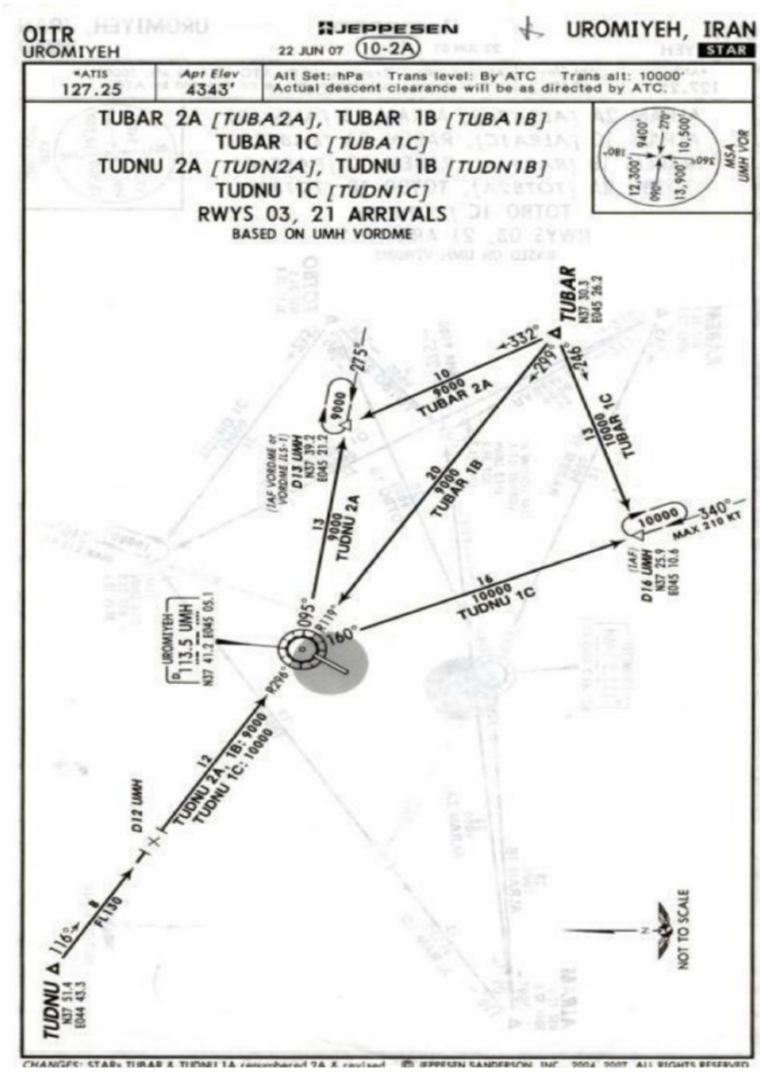
Antiskid	NO LIGHTS	F/E
Ignition	ON	F/E
Speedbrake Lever	ARM, GREEN LIGHT	C
No Smoking	ON	F/E
Gear	DOWN, IN, 3 GREEN	C
Flaps	______ ______ GREEN LIGHT	C
Hydraulics	PRESS & QTYS NORMAL	F/E
Landing Checklist	COMPLETE	F/E

According to the usual procedure in the mentioned company, the flight engineer places the Ignition Switch in the Continuous Call position at the Top of Descent. However, this instruction was not included in the existing checklist, and there was no Call Out emphasis in the CVR (Cockpit Voice Recorder). Therefore, on 21/12/89, Bulletin No. AIG363 emphasized that any changes to the Ignition Switch must be called out.

At 15:48:02 UTC, the altitude was 12,839 feet, the speed was 231 knots, and the pitch was 3.6 degrees up. The vertical acceleration (Vertical Acceleration) was 0.98 G, and the heading was 298 degrees with a turn rate of 0 degrees. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.39, 1.39, and 1.35, respectively, and the longitudinal acceleration (Longitudinal Acceleration) was +0.17 G.

At this time, according to STAR 10-2A, they begin the entry procedure for TUBAR 2A, which is authorized. The geographical coordinates of the TUBAR point are N 37 30.3, E 45 26.2.

15:48:02 UTC	17:45	PIC	Position TUBAR 130, descending, IRA 277



Additionally, other systems, including the hydraulic system, have been checked for pressure and quantity. The circuit breakers related to fuel for landing have also been checked in this section based on the CVR.

At 15:48:19 UTC, the altitude was 12,509 feet, the speed was 243 knots, and the pitch was -0.3 degrees down. The vertical acceleration (Vertical Acceleration) was 0.98 G, and the heading was 298 degrees with a turn rate of 0 degrees. The Engine Pressure Ratio (EPR) for engines 2, 3, and 4 was 1.12, 1.10, and 1.13, respectively, and the longitudinal acceleration (Longitudinal Acceleration) was +0.12 G.

From 15:48:19 UTC to 15:53:32 UTC, all three engines were in a near-idle power state based on EPR.

At 15:48:29 UTC, the sound of the switches mentioned below should be related to activating the Wing Anti-Ice system:

15:48:19 UTC	18:16	-	*sound of switches being activated*

At 15:49:30 UTC, the altitude was 10,456 feet, the speed was 255 knots, and the pitch was -0.3 degrees down. The vertical acceleration (Vertical Acceleration) was 0.99 G, and the heading was 337 degrees with a turn rate of 0 degrees. The EPR for engines 1, 2, and 3 was 1.05, 1.05, and 1.06, respectively, with a slightly higher idle power. The longitudinal acceleration (Longitudinal Acceleration) was +0.09 G.

At this time, the first officer relies on the co-pilot to maintain a constant altitude.

It is important to note that below the transition level of 11,000 feet, altitudes are based on QNH (Mean Sea Level).

15:49:30 UTC	19:17	PIC	Hold altitude at current level

At 15:49:52 UTC, the first officer wants to continue navigation using GPS after 15 seconds. However, in this aircraft, when flying with the GPS navigation device, they do not fly with the NAV mode but with the Heading mode. Although the first officer says to continue with NAV, both concepts are effectively the same.

15:49:52 UTC	19:39	PIC	For now, proceed with the heading. We will continue later if needed.

			If you want to switch to NAV press Override. OVERRIDE
15:50:07	19:54	FO	GPS-NAV

At 15:50:13 UTC, the aircraft should be at the Initial Approach Fix (IAF) with geographical coordinates N 37 39.2, E 45 21.2. The aircraft should leave the IAF on a radial of 095 degrees (Course: 275 degrees) and then enter the 11 DME ARC based on the VOR navigation device for Urmia Airport. However, the aircraft left the TUBAR point and entered the IAF directly, and after preparing the flight path, it proceeded almost directly to the final approach without completing the 11 DME ARC, which is against regulations.

At this time, the altitude was 10,168 feet, the speed was 224 knots, and the pitch was 4.1 degrees up. The vertical acceleration (Vertical Acceleration) was 0.97 G, and the heading was 298 degrees with a turn rate of 0 degrees. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.12 G.

UROMIYEH, IRAN
VOR DME ILS-1 Rwy 21

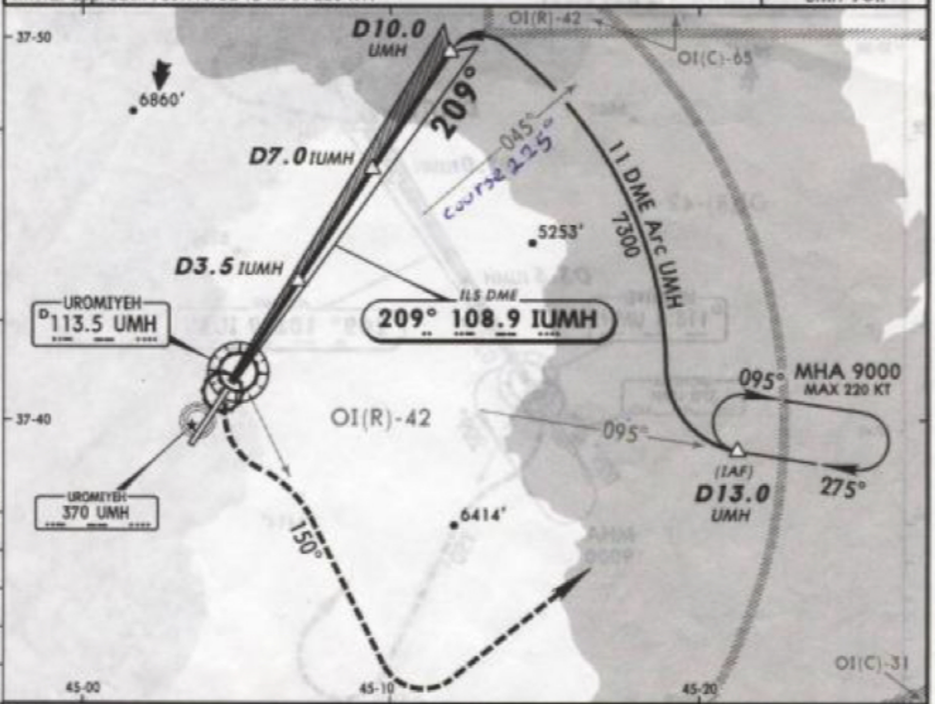
*ATIS			*UROMIYEH Tower	
127.25			118.25 121.9	
LOC IUMH 108.9	Final Apch Crs 209°	GS D7.0 IUMH 6506′(2232′)	ILS DA(H) 4510′(236′)	Apt Elev 4343′ RWY 4274′

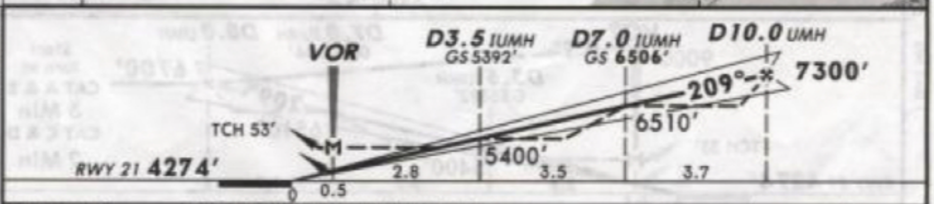
MSA UMH VOR: 12,300′ / 9400′ / 13,900′ / 10,500′ (sectors 090°–270°, 180°–360°)

MISSED APCH: Turn LEFT to intercept R-150 UMH climbing to 7000′, then turn LEFT to rejoin the holding at 9000′.

Alt Set: hPa · Rwy Elev: 147 hPa · Trans level: By ATC · Trans alt: 10000′

Initial approach restricted to MAX 220 KT.





Gnd speed-Kts	70	90	100	120	140	160
GS 3.00°	377	484	538	646	753	861
MAP at VOR						

HIALS PAPI-L

7000′ LT · UMH on 113.5 R-150

STRAIGHT-IN LANDING RWY 21

Missed apch climb gradient mim 3.8% up to 7000′

	ILS DA(H) 4510′(236′) FULL	ILS ALS out	LOC (GS out) MDA(H) 4700′(426′)	LOC ALS out
A	800m	1200m	1600m	
B	800m	1200m	1600m	
C	800m	1200m	2000m	
D	800m	1200m	2400m	

CIRCLE-TO-LAND

Not authorized between R-300 UMH & R-330 UMH

	Max Kts	MDA(H)	VIS
A	100	4770′(427′)	1600m
B	135	4840′(497′)	1600m
C	180	5290′(947′)	4400m
D	205	5400′(1057′)	4800m

PANS OPS 4

CHANGES: Minimums.

At 15:50:22 UTC during the flight, Flap 5 deg was selected. Based on the FDR, the aircraft's speed at this moment was 224 KT.

At this time, the altitude was 10,177 Ft, and the speed was 215 KT. The pitch angle was 4.6 degrees up, and the vertical acceleration (Vertical Acceleration) was 0.99. The aircraft's roll angle was 1 degree, and the EPR was 334.

The engines 1, 2, and 3 had power settings of 1.05, 1.06, and 1.06, respectively (slightly above Idle Power or at Idle Power).

The longitudinal acceleration (Longitudinal Acceleration) was 0.10 Deg.

15:50:22	20:19	PIC	Flaps moving 5.

According to the QRH (Quick Reference Handbook), Page P-7, and considering Flap retraction / Maneuvering Speed, the minimum speed has been calculated based on the actual aircraft landing weight of 64,079 Kg (141,270 lbs).

The corresponding Flap Setting 5 Deg speeds are as follows:

FLAP RETRACTION/ MANEUVERING SPEEDS

GROSS WEIGHT LB	FLAP POSITION			
	15	5	2	0
154500 & BELOW	150	160	190	200
154501 TO 176000	160	170	200	210
176001 TO 191000	170	180	210	220
191001 & ABOVE	180	190	225	235

FOR MANEUVERS IMMEDIATELY AFTER TAKEOFF EXCEEDING 15° BANK MAINTAIN AT LEAST V_2+10 AT TAKEOFF FLAPS

Gross Weight 154,500 Lbs and Below

Flap Position:
- 15 Deg = 150 Kt
- 5 Deg = 160 Kt
- 2 Deg = 190 Kt
- 0 Deg = 200 Kt

At a landing weight of 150,000 lbs and a flap setting of 5 degrees, the speed of 224 KT is within the permissible range and above the maneuvering speed of 160 Kt.

At 15:51:03 UTC, the crew decides to set the ILS frequency for Urmia Airport with an inbound course.

At this time, the altitude was 9,626 feet, the speed was 183 knots, and the pitch was 1.0 degrees up. The vertical acceleration (Vertical Acceleration) was 0.94 G, and the heading was 333 degrees with a turn rate of 0 degrees. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.12 G.

15:51:03 UTC	20:50	PIC	Set the ILS inbound course for me. (Sound of switching to the new frequency: 108.9)

At 15:51:09 UTC, the altitude was 9,451 feet, the speed was 183 knots, and the pitch was 1.0 degrees up. The vertical acceleration (Vertical Acceleration) was 1.0 G, and the heading was 334 degrees with a turn rate of 1 degree to the left. The EPR for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.13 G.

The first officer instructs the co-pilot to switch to the ADF on the RMI (Radio Magnetic Indicator), which indicates the NDB (Non-Directional Beacon). The co-pilot clarifies that they are not using the VOR (VHF Omnidirectional Range) on the RMI, as the aircraft can only display information from one of the two devices at a time. Each needle on the RMI indicates either VOR or NDB information, depending on the switch position. When the switches are set to the upper position, the needles display VOR information, and when set to the lower position, they display NDB information based on the tuned frequency.

Note: It is important to mention that at this time, the aircraft had not yet intercepted the lead radial of 045 degrees.

15:51:09 UTC	20:56	PIC	Yeah, you should also go over the NDB.
15:51:16 UTC	21:03	PIC	Yes, we no longer need the VOR.

In the Standard Operating Procedures (SOP) book for Boeing 727 of the Iranian airline company, on page 72, the following instruction is stated:

“Prior to approach, ensure that the navigation system used for the type of approach (ILS, VOR, DME, ADF) is checked with a station and is accurate.”

The approved flight procedure for this flight is VOR/DME/ILS1 - RWY 21 at Urmia Airport.

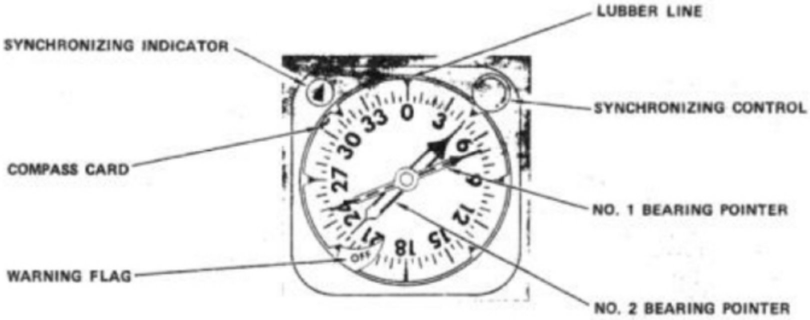
- Therefore, when the crew’s flight path is in progress and the aircraft is in an approved flight state, this process is not permitted at 11 DME relative to the VOR antenna (UMH).
- This means that the distances in this procedure range from 7 DME to 11 DME, based on the distance from the VOR (UMH) antenna and then from the ILS (IUMH) antenna.

The RMI display is as follows:

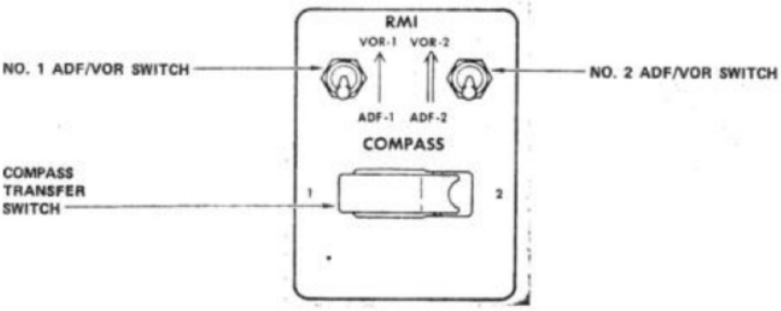
RADIO MAGNETIC INDICATOR

A radio magnetic indicator (RMI) on each pilot's panel displays magnetic heading from the compass system. (See COMPASS SYSTEM this chapter.)

Magnetic and relative bearings to selected radio facilities (VOR/ADF) are displayed by the bearing pointers.

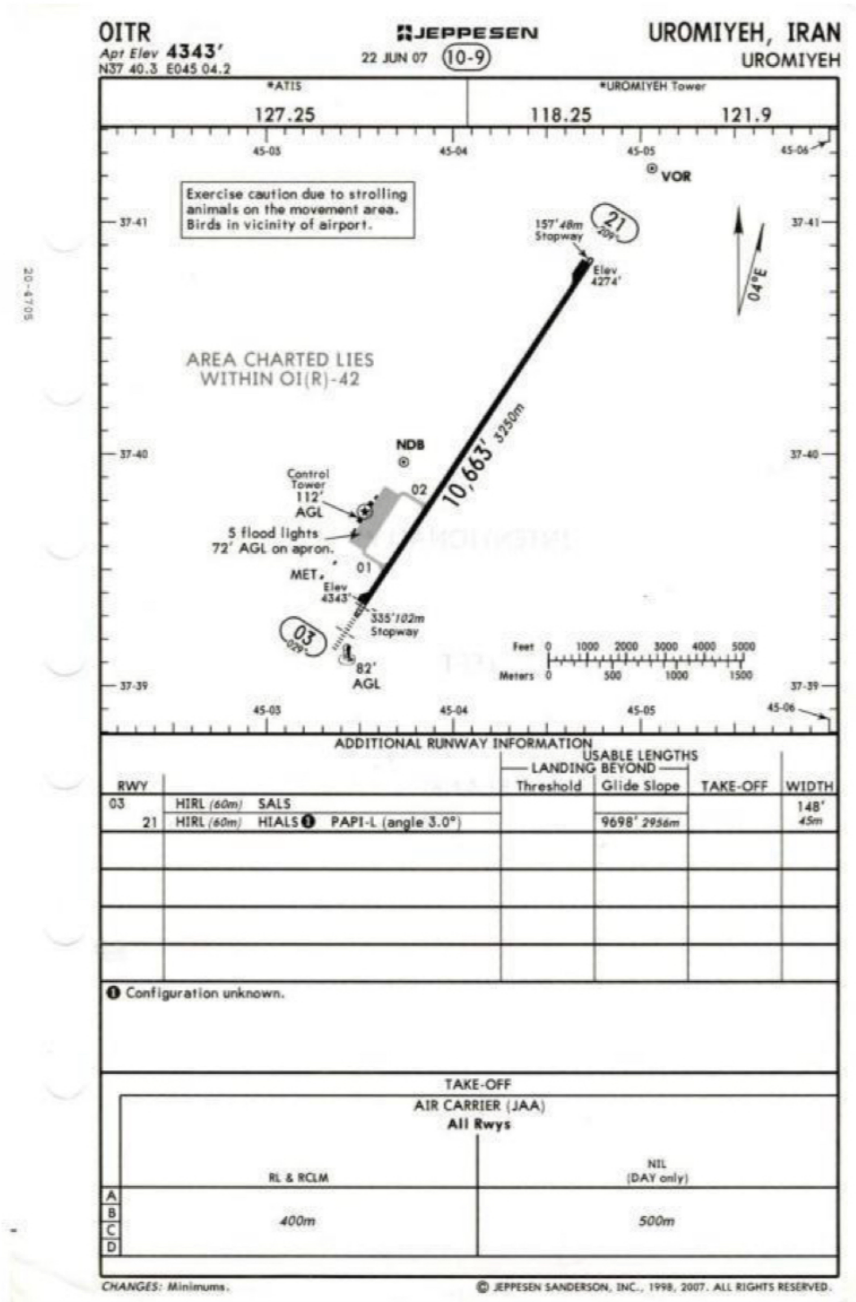


RMI



PILOTS' PANELS

RADIO MAGNETIC INDICATOR



15:51:31 UTC – At this time, the altitude was 8,878 Ft, and the speed was 189 kt with a 1.0 Deg Pitch Up. The Vertical Acceleration was 1.0, and the aircraft's bank angle was 1 Deg to the left. The EPR (Engine Pressure Ratio) of the aircraft was 335 Deg, and the EPR values of engines 1, 2, and 3 were 1.06, 1.06, 1.05 (slightly above Idle Power).

The longitudinal acceleration (Longitudinal Acceleration) was +0.11 G, with the engines operating slightly above idle power or at idle power.

The following sentence indicates that the cockpit crew was aware of the icing conditions and the weather situation. Ice formation was observed on the windshield wipers, and it is likely that the windshield bolts were also frozen.

15:51:31 UTC	21:18	FE	The power... I think the windshield wipers are frozen... *the engineer is checking*

At 15:51:39 UTC, the altitude was 8,673 feet, the speed was 190 knots, and the pitch was 1.0 degrees up. The vertical acceleration (Vertical Acceleration) was 0.98 G, and the heading was 335 degrees with a turn rate of 1 degree to the right. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.11 G.

At this time, the flight continued using the heading mode, as the GPS navigation was no longer active.

15:51:39 UTC	21:26	-	*heading select switch*

At 15:52:10 UTC, the altitude was 7,963 feet, the speed was 183 knots, and the pitch was 4.1 degrees up. The vertical acceleration (Vertical Acceleration) was 0.96 G, and the heading was 335 degrees with a turn rate of 0 degrees. The EPR for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.12 G.

At 15:52:55 UTC, the altitude was 7,137 feet, the speed was 171 knots, and the pitch was 4.6 degrees up. The vertical acceleration (Vertical Acceleration) was 1.04 G, and the heading was 302 degrees with a turn rate of 1.9 degrees. The EPR for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.17 G.

Until around this time, they had used the speed brake to reduce altitude.

15:52:55 UTC	22:42	FO	I put the Speed Brakes off now though.

At 15:53:03 UTC, the altitude was 7,064 feet, the speed was 166 knots, and the pitch was 9.9 degrees up. The vertical acceleration (Vertical Acceleration) was 1.08 G, and the heading was 321 degrees with a turn rate of 1.08 degrees to the left. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.21 G.

At this time, the first officer selected Flap 15 degrees.

15:53:03 UTC	22:50	PIC	Flap setting Fifteen.

According to the table in the QRH (Quick Reference Handbook) on page P-7, and considering Flap retraction / Maneuvering Speed, the minimum speed has been calculated based on the actual aircraft landing weight of 64,079 kg (141,270 lbs). The corresponding speeds for Flap Position 15 degrees are as follows:

Gross Weight 154,500 Lbs and Below:

Flap Position:
- 15 Deg = 150 Kt
- 5 Deg = 160 Kt
- 2 Deg = 190 Kt
- 0 Deg = 200 Kt

At a landing weight of less than 15,000 lbs and a flap setting of 15 degrees, the speed of 130 Kt is within the permissible range and below the maneuvering speed.

At 15:53:17 UTC, the altitude was 7,032 feet, the speed was 140 knots, and the pitch was 11.6 degrees up. The vertical acceleration (Vertical Acceleration) was 1.03 G, and the heading was 312 degrees with a turn rate of -14 degrees to the left. The EPR for engines 1, 2, and 3 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.23 G.

At this time, the flight crew made an error in calculating the lead radial. Based on the CVR (Cockpit Voice Recorder) conversations, they set the course to 250 degrees on the panel, using a lead radial of 070 degrees instead of the correct lead radial of 045 degrees, which resulted in a 30-degree discrepancy. Additionally, the course was later adjusted to 225 degrees, further compounding the error.

This issue is particularly critical in poor weather conditions and low visibility, as in such situations, the pilot relies solely on the aircraft's indicators. If there is an error in the settings, the indicators will also display incorrect information.

15:53:17 UTC	23:04	PIC	We are on heading 250, but the lead radial isn't correct. The heading is 250, but the lead radial is 070.

The crew made a mistake and, after disconnecting the lead radial of 070, assumed it was for intercepting the final approach and began turning. According to the procedure, after disconnecting the lead radial, the intercept heading should be set toward the runway heading, which is between 245-250 degrees. However, based on the CVR (Cockpit Voice Recorder) and FDR (Flight Data Recorder), the aircraft was flying on heading 312 degrees at this time, and the crew initiated a left turn to heading 250 degrees to intercept the localizer. However, they failed to capture the localizer and continued the left turn to heading 170 degrees, resulting in an undershoot. If they had disconnected the course of 225 degrees (radial 045), they should have turned to heading 250 degrees and listened for the missed approach instructions. Instead, they continued to turn to heading 203 degrees, but due to the errors made, the aircraft did not enter the correct localizer and glide slope cone, preventing it from capturing the localizer. It is also important to note that, according to the ATIS, the wind was 240 degrees at 6 knots, which further pushed the aircraft to the left.

Additionally, based on the approach plan for UMH (Urmia Airport), after turning toward the intercept heading, the minimum altitude for the 11 DME arc should have been 7,300 feet, but the aircraft was at 7,032 feet.

At 15:53:24 UTC, the altitude was 7,048 feet, the speed was 130 knots, and the pitch was 11.6 degrees up. The vertical acceleration (Vertical Acceleration) was 0.92 G, and the heading was 296 degrees with a turn rate of 9 degrees. The Engine Pressure Ratio (EPR) for engines 2, 3, and 4 was 1.05, 1.06, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.22 G.

At this time, based on the information from the FDR (Flight Data Recorder) and CVR (Cockpit Voice Recorder), the aircraft's controls experienced a stick shaker event. This occurred because the speed had decreased to 130 KT, which is close to the stall speed for the aircraft with Flap 15 degrees (the minimum speed for this flap setting should be 150 KT). Therefore, the pilot gave the command to increase engine power, and the stick shaker was activated until 15:54:50 UTC.

At 15:53:31 UTC, the altitude was 7,007 feet, the speed was 120 knots, and the pitch was 16.2 degrees up. The vertical acceleration (Vertical Acceleration) was 0.94 G, and the heading was 288 degrees with a turn rate of -11 degrees to the left. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.07, 1.10, and 1.06, respectively, with a power setting slightly above idle. The longitudinal acceleration (Longitudinal Acceleration) was +0.29 G. At this time, the pilot gave the command to increase engine power, but as the engines needed time to respond, the speed dropped to 116 KT, and the altitude decreased to 7,007 feet.

At 15:53:43 UTC, the altitude was 6,652 feet, the speed was 154 knots, and the pitch was 15 degrees up. The vertical acceleration (Vertical Acceleration) was 1.43 G, and the heading was 269 degrees with a turn rate of -6 degrees to the left. The EPR for engines 1, 2, and 3 was 2.17, 2.13, and 2.14, respectively. The longitudinal acceleration (Longitudinal Acceleration) was +0.60 G. At this time, the Enhanced Ground Proximity Warning System (EGPWS) issued a warning of 2,500 feet per minute descent.

15:53:43 UTC	23:30	EGPWS ALERT	TWENTY-FIVE HUNDRED

At 15:53:45 UTC, the altitude was 6,644 feet, and the speed was 152 knots. The minimum flight altitude at this time should have been 7,300 feet. The pitch was 13.7 degrees up, and the vertical acceleration (Vertical Acceleration) was 1.06 G. The heading was 269 degrees with a turn rate of -9 degrees to the left. The EPR for engines 1, 2, and 3 was 2.19, 2.18, and 2.17, respectively. The longitudinal acceleration (Longitudinal Acceleration) was +0.42 G. The engine power was increased to compensate for the stick shaker, but the aircraft was still in an incorrect turn, approaching go-around power.

At 15:54:05 UTC, the altitude was 6,999 feet, and the speed had increased to 154 knots. The pitch was 9.9 degrees up, and the vertical acceleration (Vertical Acceleration) had been compensated.

The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.75, 1.75, and 1.75, respectively. The heading was 216 degrees, and the turn rate was -26 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.04 G, and the longitudinal acceleration (Longitudinal Acceleration) was +1.81 G. At this time, the first officer, who was still in control of the aircraft, told the captain to continue with the current heading, as the aircraft was still in an incorrect turn.

15:54:05 UTC	23:52	PIC	Continue with the current Heading, I will handle it.

At 15:54:12 UTC, the co-pilot wanted to set the ILS frequency to 108.9. The aircraft's position was such that its heading was 199 degrees, its altitude was 7,064 feet, and its speed was approximately 156 KT.

15:54:12 UTC	23:59	FO	ILS frequency 108.9, set ILS frequency (confirmed.)

At 15:54:21 UTC, the co-pilot wanted to disengage the autopilot, which was in Mode 3 (some autopilot functions were active). However, the captain did not agree to disengage it.

15:54:21 UTC	24:08	FO	Should I disengage the Autopilot?

At 15:54:30 UTC, the co-pilot made the following statement, indicating that the aircraft was not descending on the Instrument Landing System (ILS) glide slope, meaning it was not descending properly.

15:54:30 UTC	24:16	FO	The aircraft isn’t descending correctly.

At 15:54:44 UTC, the co-pilot, who was flying the aircraft, reported that they had captured the glide slope. It is important to note that if the aircraft is not within the lateral cone of the localizer, even if it has captured the glide slope, it must still descend after passing the Final Approach Fix (FAF).

15:54:44 UTC	24:31	FO	Glide Slope captured.

At 15:54:45 UTC, the aircraft's heading began to increase again, reaching 210 degrees, and the altitude rose to 7,195 feet.

At 15:54:47 UTC, the captain told the co-pilot the following, indicating that the co-pilot had made a mistake. The aircraft had not captured the localizer (from the ILS antenna) and was still outside the lateral cone of the ILS, meaning it had not properly aligned with the glide slope.

15:54:47 UTC	24:34	PIC	You didn't get the Glide slope, you got the localizer

At 15:54:50 UTC, the aircraft was at a heading of 227 degrees, an altitude of 6,983 feet, and a speed of 179 KT. The landing gear was lowered at this time.

At 15:54:50 UTC, the aircraft had a speed of 182 KT and an altitude of 6,910 feet. The Engine Pressure Ratio (EPR) for engines 1, 2, and 3 was 1.10, 1.08, and 1.07, respectively, with the engines operating slightly above idle power.

Note: It is important to mention that at this time, there was heavy snowfall. Meteorological reports indicated snowfall, and the position of the wipers on the high setting suggests that there was heavy snowfall during the approach phase.

The image below shows the position of the wipers switch (set to high) after the incident.

The next image also shows that the pilot has set the speed bug on the Airspeed Indicator to 128 KT for Vref (landing reference speed), based on the flight engineer's calculations. This indicates that the correct speed has been calculated.

At 15:54:51 UTC, the first officer, who had been the Non-Flying Pilot (PNF) until now, took control of the aircraft from the co-pilot and became the Pilot Flying (PF).

15:54:51 UTC	24:38	PIC	I am taking control now, I'm the pilot flying.

At this time, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.10, 1.08, and 1.07, respectively, operating slightly above idle power. The aircraft's speed was 182 KT, and the altitude was 6,910 feet.

At 15:55:00 UTC, 4 seconds later, the aircraft was at a distance of 5 or 6 DME from the runway threshold.

15:55:00 UTC	24:47	FO	Five or six DME.

At this time, the engines 1, 2, and 3 had EPRs of 1.06, 1.06, and 1.05, respectively, operating slightly above idle power. The aircraft's speed was 170 KT, the altitude was 6,741 feet, the heading was 244 degrees, and the pitch was 10.3 degrees up.

At 15:55:10 UTC, the speed continued to decrease, and the flight engineer repeatedly reminded the crew about the speed. The aircraft's speed had decreased to 143 KT and was approaching 139 KT, which is below the minimum speed of 150 KT for Flap 15 degrees. Additionally, the engines 1, 2, and 3 had EPRs of 1.06, 1.06, and 1.06, respectively, operating slightly above idle power. This condition persisted from 15:54:53 UTC to 15:55:15 UTC.

15:55:10 UTC	24:57	FE	SPEED SPEED!
15:55:13 UTC	25:00	FO	SPEED SPEED!
15:55:14 UTC	25:01	PIC	I am increasing the speed!

At 15:55:14 UTC, the engines were still operating slightly above idle power. The aircraft's speed was 139 KT, the altitude was 6,902 feet, the pitch was 4.6 degrees up, and it was rolling -21 degrees to the left.

At 15:55:17 UTC, the aircraft's engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.23, 1.20, and 1.10, respectively. The aircraft's speed was 141 KT, the altitude was 6,813 feet, the heading was 214 degrees, and the pitch was 3.1 degrees down. The aircraft was rolling -12 degrees to the left.

At 15:55:21 UTC, the Enhanced Ground Proximity Warning System (EGPWS) issued a warning of a descent rate of 2,500 feet per minute (Sink Rate, Sink Rate). The engines 1, 2, and 3 had EPRs of 1.44, 1.42, and 1.40, respectively. The aircraft's speed was 155 KT, the altitude was 6,580 feet, the heading was 213 degrees, and the pitch was -7.5 degrees down. The vertical acceleration (Vertical Acceleration) was -7.5 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.18 G.

15:55:21 UTC	25:08	EGPWS Alert	TWENTY-FIVE HUNDRED
15:55:26 UTC	25:13	EGPWS Alert	SINK RATE, SINK RATE

At 15:55:31 UTC, in response to a query from air traffic control, the co-pilot declared a go-around (aborted landing). The engines 1, 2, and 3 had EPRs of 1.53, 1.52, and 1.44, respectively. The aircraft's speed was 182 KT, the altitude was 5,953 feet, the heading was 217 degrees, and the pitch was 7.1 degrees up. The aircraft was rolling -2 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.37 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.28 G.

15:55:27 UTC	25:14	TWR	Roger IRA 277, confirm continue for landing?
15:55:31 UTC	25:18	FO	Negative IRA 277 (To Air Traffic control)

It is important to note that, according to the report, the visibility at 15:50:00 UTC was 800 meters, and the cloud ceiling was 1,500 feet above ground level. Given that Urmia Airport's elevation is 4,343 feet MSL, the aircraft was approximately 5,843 feet MSL during the approach, meaning it was above the clouds. The lowest altitude the aircraft reached during the final approach, according to the FDR (Flight Data Recorder), was 5,938 feet MSL at 15:55:32 UTC. However, since the aircraft was not within the ILS cone, the pilot had to execute a go-around.

At 15:55:39 UTC, 7 seconds later, the captain gave the command to increase engine power to execute a missed approach, as the aircraft was not descending properly.

At 15:55:39 UTC, the captain requested an increase in engine power to abort the landing. The reaction to the increase in engine power was recorded in the FDR (Flight Data Recorder) at 15:56:07 UTC, 28 seconds later.

At this time, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.53, 1.52, and 1.44, respectively. The aircraft's speed was 171 KT, the altitude was 6,024 feet, the heading was 217 degrees, and the pitch was 10.7 degrees up. The aircraft was rolling -2 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.37 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.28 G.

15:55:39 UTC	25:26	PIC	Made missed Approach.

According to the Normal Procedure section (Page 03.20.40) of the Operations Manual, the Standard Operating Procedure (SOP) for a Go Around is described in the Cockpit Crew section of the manual, with the responsibilities of the three crew members clearly defined. This is also detailed on page 82 of the aircraft manual.

PILOT FLYING	PILOT NOT FLYING	FLIGHT ENGINERER
Thrust levers – ADVANCE TO GO AROUND EPR Auto pilot(if applicable) DISENGAGE Call out GOAROUND		EPR indication monitor
Flight director – GO AROUND Rotate to go around attitude		
F/D GO AROUND annunciator illuminates Green, mode selector automatically trips to GA, command bars direct wings level, and approximately10 degrees pitch up	Adjust engine thrust as required.	Monitor forward engine instrument Panel.
Call FLAPS 25. at bug +10 call flaps 15.	Position flap lever 25 then 15 and monitor retraction.	.
When positive rate of climb indicated, Call GEAR UP.	Position landing gear lever UP and check for normal gear retraction.	Scan panel for warning lights, hydraulic quantity normal and tail skid retraction.
Initiate flap retraction on flap/speed schedule.	Select flaps as directed and reply FLAPS------ when selected ,monitor flap and leading edge device retraction.	
THRUST – SET Reduce to that required for pattern or climb. If climb, call for F/E to set climb EPR.		If directed, set climb EPR.
FLIGHT DIRECTOR – FLT INST Reset pitch command as desired.		Accomplish after T/O procedures.
Call for AFTER TAKE OFF check list.		Read AFTER TAKE OFF check list

According to the procedure mentioned above, the flight engineer should now read the After Take-Off Check List.

AFTER TAKEOFF

Ignition	OFF/ON	F/E
No Smoking & Seat Belt	OFF/ON	F/E
Anti-Ice	CLOSE/OPEN	F/O
Gear	UP & OFF	F/O
Flaps	UP, NO LIGHTS	F/O
Auto Pack Trip Switch	CUTOUT	F/E
Hydraulics	PRESS & QTY NORMAL	F/E
Pressurization	CHECKED & SET	F/E
After Takeoff Checklist.	COMPLETE	F/E

At 15:55:46 UTC, the controller requested the pilot to report when the aircraft reached the Initial Approach Fix (IAF) and the pilot agreed. The aircraft's engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.26, 1.21, and 1.23, respectively. The aircraft's speed was 153 KT, the altitude was 6,190 feet, the heading was 223 degrees, and the pitch was 13.3 degrees up. The aircraft was rolling 2 degrees to the left. The vertical acceleration (Vertical Acceleration) was 0.96 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.18 G.

15:55:46 UTC	25:32	TWR	Roger, Report joining initial Approach Fix.

At 15:55:57 UTC, the pilot decided to abort the approach and follow the missed approach procedure. The pilot set the VOR frequency to 150 degrees for the course at 15:56:59 UTC.

15:55:57 UTC	25:44	PIC	Set course to 150 degrees.

According to the procedure, the pilot should take the following actions for a missed approach:

Missed Approach: Turn left to intercept radial 150 degrees UMH, climb to 7,000 feet, then turn left to rejoin the holding pattern at 9,000 feet.

At 15:56:07 UTC, 28 seconds later, the reaction to the increase in engine power was observed in the FDR (Flight Data Recorder). At this time, the engines 1, 2, and 3 had EPRs of 1.74, 1.70, and 1.63, respectively. The aircraft's speed was 134 KT, the altitude was 6,277 feet, the heading was 203 degrees, and the pitch was 5.9 degrees up. The aircraft was rolling -17 degrees to the left. The speed had even dropped to 128 KT at 15:56:02 UTC, which is below the minimum speed for the current flap setting. The pilot had gradually increased engine power to avoid overspeed, but the high speed was not a concern at this time.

According to the FDR, when the aircraft was at an altitude of 6,277 feet, the temperature at Urmia Airport was 0 degrees Celsius. The airport's elevation is 4,343 feet above sea level. All three engines were operating below an EPR of 2.00.

This is a correction for the relevant time when Engine & Wing Anti-Ice is on. However, considering the tables below or applying the necessary corrections, the EPR (Engine Pressure Ratio) should be above 2.00, indicating insufficient power from all three engines at this time.

According to the GO AROUND EPR tables in the Operations Manual – Page 23.10.55, for a pressure altitude of 3,900 feet, the EPR values for engines 2 and 3 are as follows:

OAT	F	10	18	27	38
	C	-13	-8	-3	3
TAT-C		-10	-5	0	5
ENG 1&3		2.26	2.23	2.20	2.17
ENG 2		2.28	2.25	2.22	2.19

In these conditions, with a weight of approximately 140,000 lbs, Engine Anti-Ice & Wing Anti-Ice open, and a temperature of 0 degrees Celsius at Urmia Airport, if a Go Around is performed with Flap 30 degrees, the EPR for engines 1, 2, and 3 would be 2.09, 2.28, and 2.09, respectively, and the speed would be 139 KT. However, considering that this aircraft, under the same conditions but with Flap 15 degrees, has EPR values of 2.18, 2.21, and 2.18 for engines 1, 2, and 3, respectively, the EPR values should be reduced when Engine & Wing Anti-Ice is on. Specifically, the EPR values should be 2.09, 2.15, and 2.09 for engines 1, 2, and 3, respectively.

Additionally, the EPR Bleed Corrections are specified in the table below:

EPR BLEED CORRECTIONS	ENG1&3	ENG 2
AIR CONDITIONING	OFF +.04	ON -.04

ENGINE ANTI ICE ON		- -.03*	-.03 -.06*
ENGINE & WING ANTI ICE ON	2 ENG BLEED	-.09 -.12*	-.03 -.06*
	1 ENG BLEED	-.10 -.13*	-.03 -.06*
6 TH STAGE BLEED ON (IF INSTALLED)			
10 DEG C(50 DEG F) OAT OR TAT AND WARMER		-	-.05
IN SHADED AREA , COLDER THAN 18 DEG C(0 DEG F) OAT OR TAT WITH A/I OFF		-	-.03
MOD “A” INLET NOT INSTALLED		-	-.01

*Use in Shaded Area, Colder Than -18 Deg C TAT

At 15:56:10 UTC, the pilot gave the command to put the landing gear up, and the landing gear was put up. The engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 2.00, 1.98, and 1.91, respectively. The aircraft's speed was 142 KT, the altitude was 6,182 feet, the heading was 196 degrees, and the pitch was 3.2 degrees up. The aircraft was rolling -21 degrees to the left. The vertical acceleration (Vertical Acceleration) was 0.96 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.35 G. At this time, it is noted that the engines had not yet reached the required power.

15:56:10 UTC	25:57	PIC	Landing gears up please.

At 15:56:14 UTC, the engines 1, 2, and 3 had EPRs of 2.09, 2.06, and 2.10, respectively. The aircraft's speed was 142 KT, the altitude was 6,024 feet, the heading was 186 degrees, and the pitch was 3.2 degrees up. The aircraft was rolling -22 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.14 G, and the longitudinal acceleration (Longitudinal Acceleration) had increased.

At 15:56:19 UTC, according to the FDR (Flight Data Recorder), the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 2.12, 2.13, and 2.10, respectively, as the engine speed increased. This indicates that the engines had reached the Go Around EPR, and this value was even slightly higher than the calculated EPR for engines 2 and 3, showing that the engines had gained good acceleration, albeit later than expected. The aircraft's speed was 174 KT, the altitude was 5,914 feet, and the heading was 174 degrees. It is important to note that the aircraft had Flap 15 degrees set until the last moment of the approach.

At 15:56:24 UTC, the pilot decided to retract the flaps to 5 degrees to abort the approach. The engines 1, 2, and 3 had EPRs of 2.11, 2.13, and 2.11, respectively. The aircraft's speed was 187 KT, the altitude was 5,844 feet, the heading was 165 degrees, and the pitch was 3.7 degrees up. The aircraft was rolling -27 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.09 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.32 G.

15:56:24 UTC	26:11	PIC	Flap 5, please

At 15:56:30 UTC, based on the explained procedure, the decision was made to climb to the altitude specified in the plan (first to 7,000 feet, then to 9,000 feet for the Initial Approach Fix). The engines 1, 2, and 3 had EPRs of 1.52, 1.48, and 1.47, respectively. The aircraft's speed was 191 KT, the altitude was 5,836 feet, the heading was 147 degrees, and the pitch was 5.5 degrees up. The aircraft was rolling -22 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.03 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.22 G.

15:56:27	26:14	FE	Climb to 7000 feet.
15:56:30	26:17	PIC	Climb to 9000 feet after 7000.

At 15:57:07 UTC, the VOR frequency for the missed approach had not yet been set on the panel. The engines 1, 2, and 3 had EPRs of 1.53, 1.48, and 1.47, respectively. The aircraft's speed was 169 KT, the altitude was 6,572 feet, and the heading was 162 degrees.

The aircraft was rolling to the right at a rate of +10.3 degrees. The vertical acceleration (Vertical Acceleration) was 1.01 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.26 G.

15:56:56	26:43	PIC	What is the VOR frequency?
15:56:59	26:46	FO	113.5
15:57:01	26:48	PIC	Set 113.5 on the VOR.
15:57:07	26:54	FO	……. Identity Confirmed, 113.5.

According to the missed approach procedure, the pilot should direct the aircraft toward the Urmia Airport VOR antenna, then turn left and intercept the outbound radial of 150 degrees (i.e., intercept from the right side of the 150-degree radial). The aircraft should then climb to 7,000 feet, turn left, and climb to 9,000 feet to enter the holding pattern. This procedure is specified in the approach chart.

Based on the radar screen and FDR (Flight Data Recorder), the aircraft moved toward the VOR but did not turn left from the radials 080, 090, 100, 110, 120, 130, 140, etc., as it should have. Instead, it intercepted the 150-degree radial from the left side (i.e., from the opposite direction) and climbed to 7,000 feet. The aircraft then began climbing to 9,000 feet, but the pilot executed the missed approach procedure incorrectly.

At 15:59:13 UTC, according to the FDR, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.46, 1.46, and 1.51, respectively. The aircraft's speed was 208 KT, the altitude was 8,451 feet, and the heading was 151 degrees (almost on the 150-degree radial). The pitch was 5.5 degrees up, and in the previous seconds, it was 8.1 degrees up. The aircraft was rolling -29 degrees to the left.

At 15:59:27 UTC, based on the FDR and radar screen, the aircraft was on the 150-degree radial. The captain decided to rejoin the approach plan toward the Initial Approach Fix (IAF), which in this situation was on the outbound course of 095 degrees.

The co-pilot mistakenly set the course to 275 degrees instead of the correct value, but the captain later corrected it to 095 degrees. However, the captain did not immediately point out the error. According to the FDR (Flight Data Recorder), the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.38, 1.31, and 1.32, respectively. The aircraft's speed was 181 KT, the altitude was 8,801 feet, the heading was 060 degrees, and the pitch was 5 degrees up. The aircraft was rolling -33 degrees to the left. Based on the FDR, it is evident that the aircraft gradually turned left, with the nose moving from 151 degrees to 060 degrees, which is also visible on the radar screen.

After 17 seconds, the co-pilot reported the distance from the Urmia Airport VOR as 14 DME (this distance is equivalent to 0.5 NM before the runway).

15:59:27 UTC	29:14	PIC	Radial 375.
15:59:29 UTC	29:16	FO	Set 375, set 375, and initial.
15:59:44 UTC	29:31	FO	DME Distance is increasing.
15:59:48 UTC	29:35	FO	14 DME (corrected.)
16:00:20	30:07	PIC	Turn to Outbound 095? Heading 092?

The captain made another mistake in stating the radial as 375 degrees, as when intercepting an outbound radial, the course and radial are the same, and in this case, both values should be 095 degrees.

At 16:00:16 UTC, according to the FDR, the engines 1, 2, and 3 had EPRs of 1.36, 1.30, and 1.30, respectively. The aircraft's speed was 174 KT, the altitude was 8,792 feet, the heading was 000 degrees, and the pitch was 6.9 degrees up. The aircraft was rolling -15 degrees to the left. If observed carefully, it can be seen that the aircraft gradually turned left, with the nose moving from 060 degrees to 000 degrees, and this left turn continued until the heading reached 350 degrees. This indicates that the captain was still turning left toward 350 degrees, meaning he was still trying to intercept the 275-degree radial.

From 16:00:27 UTC, the aircraft began turning to the right, which is also visible on the radar screen and the corresponding animation.

At 16:00:32 UTC, a strange event occurred, as the aircraft was turning to the left for an unknown reason. However, the heading or direction of the aircraft should have been turning to the right. This indicates aerodynamic changes, which are also visible in the animation (FDR) and became more pronounced in the following seconds!!!

At 16:00:38 UTC, the aircraft was still turning to the right, with a roll angle of -21 degrees, and its heading was 358 degrees, indicating a 4-degree turn.

At 16:00:41 UTC, the stick shaker was heard on the CVR (Cockpit Voice Recorder), indicating that the aircraft was approaching the stall speed, which caused the controls to become ineffective.

According to the FDR (Flight Data Recorder), the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.36, 1.25, and 1.30, respectively. The aircraft's speed was 170 KT, the altitude was 8,767 feet, the heading was 358 degrees, and the pitch was 8.7 degrees up. The aircraft was rolling -26 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.10 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.30 G.

If observed carefully, it can be seen that the aircraft's altitude was still decreasing, and this is also visible on the radar screen and the corresponding animation.

Additionally, the aircraft's bank angle increased from -26 degrees to -41 degrees in 6 seconds, indicating a leftward turn.

Note: Considering the stick shaker, the pilot should correct the aircraft's speed according to the procedures outlined in the FCT 727 TM manual, specifically in the Airwork – Cruise Maneuvers section (Page 04.25.25, Contact A Factor). This procedure applies when the aircraft is at low altitude and near terrain. The first signs of a stall, such as buffet or stick shaker, require the pilot to push the throttle to the Go Around position to increase thrust and prevent a stall. Then, the pilot should adjust the pitch to an appropriate level to avoid a secondary stall. Additionally, sudden control inputs should be avoided to prevent the aircraft from losing speed and altitude, ensuring it does not collide with the ground.

At 16:00:50 UTC, the pilot gave the command to increase power 9 seconds after the stick shaker was activated, which indicates a delay in responding. Additionally, since the aircraft was in a slight bank, the pilot should have also adjusted the pitch to recover from the bank.

16:00:50 UTC	30:37	PIC	Power!! Power!!

Note: At this time, with Flap 5 degrees, the normal maneuvering speed for this aircraft is 160 KT. However, the aircraft was flying at 170 KT, which is significantly higher than the normal speed, especially during a stick shaker event. The aircraft was in a hard left turn with a bank angle of -27 degrees, and the vertical acceleration (Vertical Acceleration) was 1.20 G.

16:00:41 UTC	30:39	-	(Stick shaker sounds)

1. Stick Shaker Condition 1:Simulated at an altitude of 8,900 feet, speed of 169 KT, pitch of 11 degrees up, and Engine Pressure Ratios (EPR) of 1.36, 1.26, and 1.30 for engines 1, 2, and 3, respectively. With Flap 5 degrees, Wing & Engine Anti-Ice open, and no bank, the aircraft experienced a stick shaker at 140 KT.

2. Stick Shaker Condition 2: The same conditions as above were simulated again, but with a bank angle of -27 degrees. The aircraft experienced a stick shaker at 144 KT.

These simulations confirmed that factors other than the above conditions, such as icing, could also cause a stick shaker event. In the simulation, the aircraft experienced a stick shaker at 169 KT due to icing.

It is important to note that simulating icing conditions is not possible in the simulators available in Iran.

During a simulator session on November 8th, 2011, the operations group leader and one of the engine group members were present. On January 21st, 2012, the operations group leader, aircraft systems expert, and FDR & CVR (Flight Data Recorder and Cockpit Voice Recorder) expert were present. All three agreed that the load factor gradually increased, leading to a stall speed increase, which caused the stick shaker event.

In this investigation, it was also confirmed that the flight engineer, in addition to the Pilot Flying, adjusts the engine power during the flight. That is, the Pilot Flying first increases or decreases the engine power, and then the flight engineer monitors and precisely adjusts it.

At 16:00:44 UTC, according to the FDR (Flight Data Recorder), the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.48, 1.46, and 1.53, respectively. The aircraft's speed was 168 KT, the altitude was 8,741 feet, the heading was 344 degrees, and the pitch was 12.0 degrees up. The aircraft was rolling -28 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.19 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.29 G.

At 16:00:45 UTC, the engines 1, 2, and 3 had EPRs of 1.16, 1.17, and 1.19, respectively. The aircraft's speed was 165 KT, the altitude was 8,741 feet, the heading was 341 degrees, and the pitch was 12.9 degrees up. The aircraft was rolling -30 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.20 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.24 G.

At 16:00:48 UTC, the engines 1, 2, and 3 had EPRs of 1.07, 1.05, and 1.06, respectively. At this moment, if observed carefully, it can be seen that all three engines experienced a significant reduction in power. The aircraft's speed was 155 KT, the altitude was 8,750 feet, the heading was 334 degrees, and the pitch was 12.4 degrees up. The aircraft was rolling -38 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.04 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.16 G. From two seconds earlier, it can be seen that the power of all three engines was automatically decreasing toward idle power.

Based on the above analysis, it can be said that icing may have started disrupting the smooth airflow over the wings before this moment. If we consider the meteorological report, which indicated light to moderate icing in this area, it is possible that the aircraft encountered moderate icing in this region.

With a bank angle of -27 degrees (within the standard range) and a pitch of 9.4 degrees up, the turbulence over the wings increased. This turbulent airflow, combined with the placement of the engines on this aircraft, also disrupted the airflow entering the engine inlets, causing engine rollback.

In this situation, compressor surge occurred, leading to a rollback of the engines. Despite the throttle being increased, the EPR decreased, resulting in reduced acceleration and power in all three engines.

Aircraft Gas Turbine Operation Information Letter No: 4 discusses this issue in detail. It is referenced in Additional Information For P &W General Operating Instructions, which is included as a supplement to PWA OPER. INSTRS. 190/191.

At 16:00:50 UTC, the pilots noticed the stick shaker sound along with vibrations in the yoke. The captain then instructed the flight engineer to increase engine power to the Go Around setting. According to the FDR (Flight Data Recorder), at this time, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.21, 1.36, and 1.09, respectively. The aircraft's speed was 149 KT, the altitude was 8,715 feet, the heading was 315 degrees, and the pitch was 10.3 degrees up. The aircraft was rolling -24 degrees to the left.

The vertical acceleration (Vertical Acceleration) was 0.96 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.20 G.

16:00:50 UTC	30:37	PIC	Power, Power!!
16:00:51 UTC	30:38	FO	Yes.
16:00:52 UTC	30:39	FE	Go around for me!
16:00:53 UTC	30:40	PIC	Go around, set.

In the Flight Manual â€“ Supplementary Procedures â€“ Adverse Weather (Page 04.25.16), it is stated that engine power should be increased in extremely heavy precipitation conditions. It is important to note that this section is titled Engine Operation In Heavy Rain or Hail. However, according to meteorological reports, the weather conditions at the time were heavy snow, not rain or hail, and there was no extremely heavy precipitation.

It would have been better if the pilot had increased engine power more aggressively, considering that the engines were experiencing rollback at 16:00:46 UTC.

Do not make rapid thrust changes in extremely heavy precipitation (rain or hail) unless excessive airspeed variations occur. If thrust changes are necessary, move the thrust levers very slowly. Avoid changing thrust lever positions abruptly.

Based on the conducted investigation, the acceleration time of the engines is of significant importance. Therefore, the engines were evaluated during the flight, and the results are as follows:

From Idle Power To Go Around	ENG 1	ENG 2	ENG3
Without Eng & Wing Anti Ice	6 Sec	7 Sec	6 Sec
With Eng Anti Ice Open	7 Sec	8 Sec	7sec
With Eng & Wing Anti Ice	8 Sec	9 Sec	8sec
From Cruise Power To Climb Power			3-4 Sec

At 16:00:54 UTC, according to the FDR (Flight Data Recorder), the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 2.03, 2.07, and 2.27, respectively. The aircraft's speed was 149 KT, the altitude was 8,604 feet, the heading was 302 degrees, and the pitch was 8.6 degrees up. The aircraft was rolling -39 degrees to the left. As is evident, the EPR of engine 1 did not increase, and it was 1.31 one second earlier, indicating a decreasing trend in the power of engine 1 at this moment.

At 16:00:59 UTC, the engines 1, 2, and 3 had EPRs of 2.21, 2.10, and 1.83, respectively. The aircraft's speed was 150 KT, the altitude was 8,307 feet, the heading was 278 degrees, and the pitch was 12.4 degrees up. The aircraft was rolling -32 degrees to the left. The power of engine 1 increased slightly, and the FDR graph shows that the power of this engine was continuously fluctuating.

At 16:01:00 UTC, the engines 1, 2, and 3 had EPRs of 2.09, 1.39, and 1.21, respectively. The aircraft's speed was 148 KT, the altitude was 8,273 feet, the heading was 275 degrees, and the pitch was 13.7 degrees up. The aircraft was rolling -25 degrees to the left. At this moment, the speed of engine 3 also decreased significantly.

16:01:06 UTC	30:53	TWR	IRA 277, what is your intention?
16:01:07 UTC	30:54	PIC	Turn up the Power!!
16:01:08 UTC	30:55	PIC	Make a go around.
16:01:09 UTC	30:56	FO	Make a go around IRA 277. (Confirming go around) (The pilots frightened voice tries to help)

Since the throttle levers had already been pushed forward, the captain's instruction to increase engine power to the firewall was correct. However, only engine 2 responded, as engines 1 and 3 had already failed. The EPR of engine 2 was 2.11.

It is important to note that the transition altitude at Urmia Airport is 10,000 feet, and the reference pressure for the altimeter should be set to QNH: 1015, meaning altitudes are measured relative to Mean Sea Level (MSL).

At 16:01:13 UTC, the flight engineer reported that two engines had failed. The engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.11, and 1.05, respectively. The aircraft’s speed was 156 KT, the altitude was 7,219 feet, the heading was 273 degrees, and the pitch was 8.1 degrees up. The aircraft was rolling +2 degrees to the right.

Note: Considering that the inlet of engine 2 is in the S-DUCT configuration, it only sends warm air for Engine Anti-Ice. However, engine 3 sends warm air not only for Engine Anti-Ice but also for Wing Anti-Ice. Therefore, engine 2 was able to recover.

It is also important to note that in the Flight Manual â€“ Supplementary Procedures â€“ Adverse Weather (Page 04.25.16a), the following is stated:

Flying in turbulence or hail may cause engine inlet airflow distortion. This distortion, along with engine icing, angle of attack changes, and high-altitude engine surge margins, can result in engine surge and flameout.

However, it should be noted that, according to meteorological reports and cockpit communications, the weather conditions did not include hail or turbulence.

At 16:01:15 UTC, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.10, and 1.05, respectively. The aircraft's speed was 154 KT, the altitude was 7,064 feet, the heading was 269 degrees, and the pitch was 10.7 degrees up. The aircraft was rolling -11 degrees to the left.

16:01:13 UTC	31:00	FE	2 Engines are gone!!
16:01:14 UTC	31:01	FO	GODDAMN IT!!
16:01:14 UTC	31:01	TWR	IRA 277, read you in and out, would you say again?
16:01:15 UTC	31:02	FE	Yeah! (To FO)

During a simulator session on Feb 10th, 2012, it was confirmed that when the engines experience a fail, parameters such as the EPT, EPR and N1 decrease. When the oil pressure drops significantly, the yellow warning lights for Engine Failure illuminate. Therefore, the flight engineer also noticed the engine failure based on the decreasing trend of these parameters.

At 16:01:16 UTC, the co-pilot asked the captain (PF) if he should retract the flaps, and this question was repeated in the following seconds. The engines 1, 2, and 3 had EPRs of 1.06, 2.02, and 1.05, respectively. The aircraft's speed was 152 KT, the altitude was 6,983 feet, the heading was 268 degrees, and the pitch was 12 degrees up. The aircraft was rolling -7 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.16 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.22 G.

At 16:01:19 UTC, the captain instructed the co-pilot to inform Urmia Tower that they were returning to Tehran. At this time, the engines 1, 2, and 3 had EPRs of 1.06, 2.05, and 1.06, respectively. The aircraft's speed was 147 KT, the altitude was 6,749 feet, the heading was 267 degrees, and the pitch was 14.1 degrees up.

The aircraft was rolling -4 degrees to the left. The vertical acceleration (Vertical Acceleration) was 0.93 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.18 G.

At 16:01:21 UTC, the sound of an engine restart was heard on channels 2 and 4 of the CVR (Cockpit Voice Recorder). However, no sound of the engine actually starting was heard, and the engine parameters in the FDR (Flight Data Recorder) also did not indicate that the engine had started. The captain was asked again about this at 16:01:30 UTC.

According to the Quick Reference Handbook (QRH) for the aircraft, the Inflight Start procedure is as follows:

INFLIGHT START

1) Engine Condition and Srart Envelope	CHECK
2) Fire Switch	IN
3) Thrust Lever	CLOSE
4) Start Lever	CUT OFF
5) Fuel Shutoff Switch	OPEN
6) Fuel Boost Pumps	ON
7) Start Switch	FLIGHT
8) Start Lever	IDLE
9) Engine Instrument	STABILIZED
10) Start Switch	OFF
11) Electrical, Hydraulic, and Engine Bleeds	RESTORE

Inflight Start Envelope JT8D-ALL
Nominal Windmilling RPM(TOL. +/- 3)

IAS /kNOT		PRESSURE ALTITUD		
		0 FT	5000 FT	10000 FT
180	N1/N2	9/12	10/13	11/13
160		8/11	9/11	10/12

Since this aircraft is from an older generation, it is not possible to start the APU (Auxiliary Power Unit) during flight. As we know, this is particularly important during an engine failure, especially at low altitudes, because the APU can provide bleed air and electric power.

The APU (Auxiliary Power Unit) on this aircraft can only be used on the ground. Therefore, it can only be used to start the engines, and windmilling can be used for engine restarts in flight. This is mentioned in the Flight Manual – Page 08.10.04.

The Auxiliary Power Unit (APU) supplies electrical power and compressed air for ground operations only.

In the Flight Manual – Page 04.25.16, it is stated:

"It may not be possible to start engines until exiting areas of moderate to heavy rain or hail."

At 16:01:23 UTC, the EGPWS (Enhanced Ground Proximity Warning System) issued a warning of â€œTwo Thousand Five Hundred due to the rate of descent. At this time, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.04, and 1.05, respectively. The aircraft's speed was 141 KT, the altitude was 6,460 feet, the heading was 266 degrees, and the pitch was 13.7 degrees up. The aircraft was rolling -3 degrees to the left. The vertical acceleration (Vertical Acceleration) was 1.03 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.19 G.

At 16:01:29 UTC, the engines 1, 2, and 3 had EPRs of 1.06, 2.09, and 1.05, respectively. The aircraft's speed was 135 KT, the altitude was 6,024 feet, the heading was 274 degrees, and the pitch was 13.7 degrees up. The aircraft was rolling +11 degrees to the right. The vertical acceleration (Vertical Acceleration) was 0.97 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.21 G.

16:01:16 UTC	31:03	FO	Should I retract the flaps?
16:01:19 UTC	31:06	PIC	We'll make a go towards Tehran.
16:01:21 UTC	31:08	-	*Ghee Ghee Ghee* (sound of engine relighting) This sound is on channels 2 and CVR lights until the end of the recording tape.

16:01:21 UTC	31:08	PIC	IRA 277, going to Tehran (to ATC)
16:01:23 UTC	31:10	EGPWS	TWO THOUSAND FIVE HUNDRED
16:01:27 UTC	31:14	PIC	2 engines gone???

16:01:30 UTC	31:17	FE	Sir, should I relight the engines?

At 16:01:30 UTC, the EGPWS (Enhanced Ground Proximity Warning System) issued a warning due to the high rate of descent (Sink Rate). At this time, the flight engineer also realized that engine number 1 needed to be relit. They began performing this task at 16:01:21 UTC.

16:01:30 UTC	31:17	EGPWS Alarm	SINK RATE, SINK RATE
16:01:30 UTC	31:17	FE	I'm relighting Number 1. (Last words spoken by the Flight Engineer.)

At 16:01:32 UTC, the co-pilot again asked the captain if the flaps should be retracted. The captain agreed, but two seconds later, as the rate of descent increased significantly, the EGPWS (Enhanced Ground Proximity Warning System) issued a PULL UP warning as the aircraft approached the ground. The engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.10, and 1.05, respectively. The aircraft's speed was 133 KT, the altitude was 5,789 feet, the heading was 279 degrees, and the pitch was 13.3 degrees up. The aircraft was rolling +12 degrees to the right. The vertical acceleration (Vertical Acceleration) was 1.01 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.20 G.

16:01:32 UTC	31:19	FO	Should I retract the flaps?
16:01:33 UTC	31:20	PIC	No, no, we cannot retract them.

16:01:34 UTC	31:21	EGPWS Alarm	PULL UP Alarm starts

At 16:01:41 UTC, the captain (PF), while the EGPWS (Enhanced Ground Proximity Warning System) warning was repeating, gave the order to retract the flaps. The co-pilot also said, I have retracted the flaps!! This statement was repeated one second later, indicating that the co-pilot had taken the initiative to retract the flaps before the captain's order. The engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.07, and 1.06, respectively. The aircraft's speed was 97 KT, the altitude was 5,062 feet, the heading was 299 degrees, and the pitch was 15 degrees up. The aircraft was rolling +19 degrees to the right. The vertical acceleration (Vertical Acceleration) was 1.03 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.26 G.

16:01:41 UTC	31:28	PIC + EGPWS Alarm	Retract the Flaps, RETRACT THEM!! (Pull up Alarm continues)
16:01:41 UTC	31:29	FO	I have retracted them.

Additionally, if we look again at the speed table for Flap Settings, we can see that the speed in these conditions was no longer appropriate, and the pilot had no other option.

In the Operations Manual, under the Supplementary Procedures Page 44c, regarding the Wing Anti-Ice system, it is stated that this system is designed to prevent ice formation (Anti-Icing) rather than to remove ice (De-Icing). This is because if ice forms on the wings, there is a risk of ice ingestion into the engine or around the engine inlet. It is important to note that the difference between the two systems, De-Icing and Anti-Icing, has been explained at the beginning of the report.

On the same page of the manual, it is stated that in icing conditions, we should not fly for extended periods when the Leading and Trailing Edge Flaps are extended beyond 5 degrees.

It is also recommended that if the Trailing Edge Flaps are extended beyond 5 degrees in icing conditions, they should not be retracted until the ice is removed from them or until they are inspected on the ground.

Therefore, retracting the flaps in these conditions disrupted the aerodynamic shape of the wings, leading to a significant loss of lift, worsening the situation, and was a mistake.

At 16:01:47 UTC, the captain (PF), while the EGPWS (Enhanced Ground Proximity Warning System) warning was active, gave the order to restart engine number 1. The engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.09, and 1.05, respectively. The aircraft's speed was 112 KT, the altitude was 4,471 feet, the heading was 313 degrees, and the pitch was 6.8 degrees up. The aircraft was rolling +21 degrees to the right. The vertical acceleration (Vertical Acceleration) was 0.94 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.22 G.

16:01:47 UTC	31:34	PIC + EGPWS	(PULL UP) Relight number 1 quickly!!!!

It is important to note that the sound of the engine restart had been heard since a few seconds earlier.

At 16:01:48 UTC, the engines 1, 2, and 3 had Engine Pressure Ratios (EPR) of 1.06, 2.09, and 1.05, respectively. The aircraft's speed was 69 KT, the altitude was 2,220 feet, the heading was 313 degrees, and the pitch was 0 degrees up. The aircraft was rolling +21 degrees to the right. The vertical acceleration (Vertical Acceleration) was 0.94 G, and the longitudinal acceleration (Longitudinal Acceleration) was +0.22 G.

At 16:01:49 UTC, as the rate of descent (Rate of Descent) increased and the aircraft approached the ground, the EGPWS (Enhanced Ground Proximity Warning System) issued a PULL UP warning to the pilot. At this time, the FDR (Flight Data Recorder) recorded only a few parameters. The engines 1, 2, and 3 all had an EPR of 0.76. The pitch was 0.1 degrees up, and the vertical acceleration (Vertical Acceleration) was 1.31 G. The longitudinal acceleration (Longitudinal Acceleration) was -1.08 G.

16:01:49 UTC	31:36	FO + EGPWS	(PULL UP) Oh wow, we’re going down badly. (Last words spoken by First Officer)

At 16:01:50 UTC, the FDR (Flight Data Recorder) stopped recording further parameters, and only the sound of the flight engineer's attempts to restart the engines was captured on channels 1 and 4 of the CVR (Cockpit Voice Recorder). At the same time, the captain's voice was heard, and the EGPWS (Enhanced Ground Proximity Warning System) continued to issue warnings.

16:01:50 UTC	31:37		(Sounds of Engine relighting)
16:01:50 UTC	31:37	PIC EGPWS	(Pull up) WE'RE DONE FOR!! (Last words spoken by captain)
16:01:50 UTC	31:37	TWR	IRA 277- *tape ends and incomplete message by ATC is recorded as last words spoken.

Deep Stalls Recovery 04.25.18 Based on the B-727 Maneuvers Manual:

The control surfaces must be moved forward to create a nose-down pitching moment, and an altitude of approximately 4,000 feet is required to recover from a severe stall.

According to the same manual on page 04.25.20, when the aircraft is in a flap-up configuration, the center of lift moves inboard and forward toward the wing roots during a stall. However, when the aircraft is in a flap-down configuration, the center of lift moves outboard and aft toward the wingtips during a stall.

At 16:00:45 UTC, when the aircraft experienced the stick shaker, the altitude was 8,741 feet MSL (Mean Sea Level). Considering that the accident site elevation was approximately 4,307 feet MSL, the aircraft was about 4,434 feet above the ground.

It is important to note that, despite the fact that all three engines experienced rollback after this moment, and engine 3 failed after 5 seconds, followed by engine 2, attempts to restart the engines using in-flight start procedures were unsuccessful. Even though engine 2 recovered and was pushed to the firewall, the icing conditions made it impossible to fully recover.

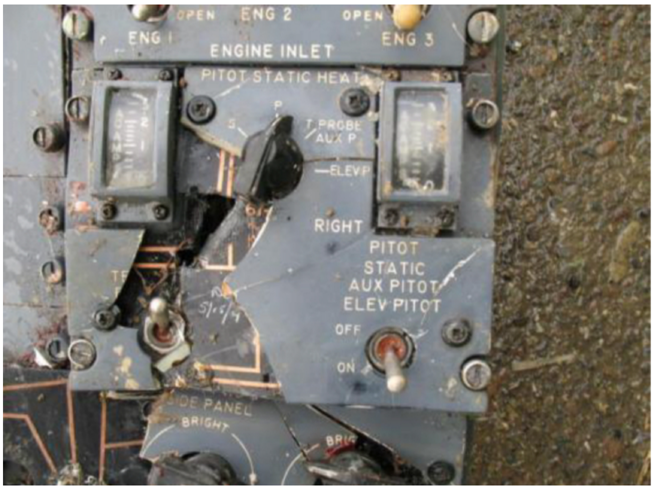
At 16:01:50 UTC, the last words from Urmia Air Traffic Control were recorded on the CVR (Cockpit Voice Recorder), no further recordings were made.

Additional Information:

1. The ATC Flight Plan for this flight was scheduled to start at 12:30 UTC. However, due to the delay in executing the flight plan, a similar flight plan with the same details was rescheduled to start at 14:45 UTC, resulting in an 87-minute delay.

The delay was caused by a GPS malfunction on the aircraft and poor visibility conditions at Urmia Airport. Before the flight, the aircraft was checked by the technical team and, after re-confirmation, it was declared ready for flight. This issue was recorded in the Aircraft Technical Flight Log Page No. 071.

2. The following image shows the status of the Pitot Static Heat system during the incident:



3. In the Flight Manual, under the Supplementary Procedures Power Plant section (Page 09), it is stated that if the temperature in the fuel tanks drops to zero degrees or below, the Fuel Heat system must be used. Therefore, when the switches for this system are turned on or off, the EPR and Oil Temperature should be monitored to determine the system's performance or failure. After one minute, it was observed that the relevant switches were not turned on.

If the Fuel Icing Light does not turn off, it is likely that the fuel filter is clogged due to contamination in the fuel, which has caused the light to remain on.

It is also emphasized that these switches should be turned on during the Takeoff, Landing, and Go-Around phases and turned off during the In-Flight phase. Additionally, it is stated that if the Fuel Icing Light flickers, the Fuel Boost Pump system should be checked before turning it on.

Since the aircraft was in the Go-Around phase, these switches should have been in the OFF position, as shown in the image below.

The image above shows that the Fuel Heat system for all three engines was in the OFF position. However, it is not clear whether this system was turned ON during the flight, as it is not heard on the CVR (Cockpit Voice Recorder). Therefore, according to Safety Bulletin No. 363 dated 12/21/89, this must be called out in the future.

4.The image below shows a form filled out by the flight engineer, which includes information about the fuel loaded, the fuel required for the destination, the flight altitude, and the flight route.

5. The image on the next page shows the engine instruments for all three engines. Initial investigations after the incident, considering the condition of the engine layers and the fuel flow rate, indicate that the fuel flow for engine 1 was almost zero, while it sharply decreased for engines 2 and 3. This created a preliminary assumption for the accident investigation team regarding the status of these two engines.

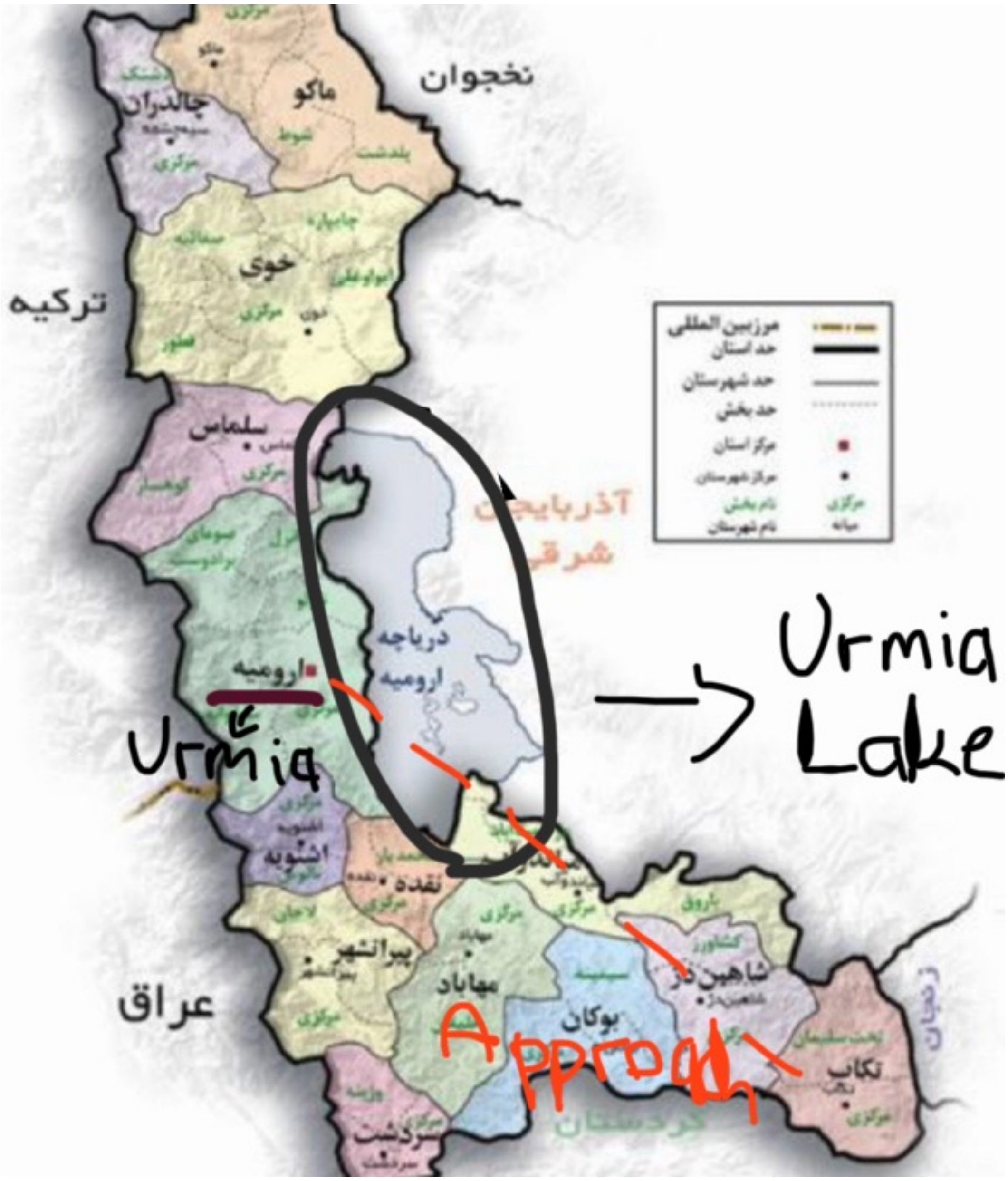
6. Figure 6 below shows that the right panel was set to the radio frequency of the Urmia Tower, but the Urmia VOR navigation system frequency was selected on the left panel. This indicates that, in the final moments, the Urmia VOR navigation system was shut down, and its antenna was no longer transmitting the radial signals.

Additionally, in photographs taken a week after the accident on another aircraft of the same model similar to aircraft EP-IRP, which was involved in the incident on 04/07/90â€"it was confirmed that this aircraft was equipped with two VHF panels with four windows. Two of these windows were for setting radio communication frequencies, while the other two were for setting the frequencies of VOR and ILS navigation systems.

7. The above figure shows the position of the Flap Lever, which is in the Up Position, and also displays the CG (Center of Gravity), which is in the lower part of the Green Band.

Operational Review of the Environmental Conditions of Urmia Lake

1. Based on the conducted research and interviews with the environmental expert in charge of the Urmia Lake station, regarding Urmia Lake and the increased likelihood of icing conditions due to the presence of the lake in the area where the approach procedure is executed, the following issues were identified:



Map of the West Azerbaijan Province in Iran, with surrounding Provinces, countries, The City of Urmia and Urmia Lake.

Some believe that Urmia Lake has caused severe icing conditions for the aircraft in question, as the approach procedure is designed to pass over it.

In this investigation, it was determined that Urmia Lake is one of the three saltiest lakes in the world. Due to the critical reduction in the lake's water level in recent years, as seen in the figure below, the water level has decreased, and the salt concentration has increased to 400 grams per liter.

In the western region of Urmia Lake, the amount of rainfall decreases from west to east.

An interview with the environmental expert in charge of Urmia Lake revealed that, due to its high salt concentration, the lake has never frozen. Although lakes generally moderate the surrounding weather conditions, this effect has been less pronounced for Urmia Lake in recent years. Even if fog forms in this area, it is very thin due to the high salt content.

Urmia County is located in West Azerbaijan Province, which is primarily influenced by moist air currents from the Atlantic Ocean and the Mediterranean Sea. During some winter months, cold air masses from the Mediterranean region affect the area, causing a significant drop in temperature.

But sometimes in addition to airflow, other factors such as distance from the open sea play an important role in temperature and precipitation levels. This means that the water and air temperature conditions in the Caspian Sea coastal region differ from those in the semi-desert interior of Iran.

During the winter season, at elevations above 3,000 meters, thick layers of snow accumulate on mountain peaks and ridges, preserving the snow until spring. Similarly, in altitudes between 1,100 and 2,000 meters, strong winds help maintain snow for a long time. The geographical situation, temporary elevation changes, and the direction of mountain ridges influence wind patterns. With the arrival of cold fronts, warm air rises and leads to the formation of precipitation. Low-pressure systems develop, replacing the northwestern rain-bearing winds with other types of airflows. These winds, particularly during autumn and winter, are more prominent over the Atlantic and Mediterranean, attracting moisture and bringing it toward the border mountains, leading to snowfall and rain accumulation. This can create icing conditions when interacting with humid air.

According to these studies, special weather and water conditions mainly affect this region from the west of Miyaneh County.

For this reason, the location of Urmia International Airport is subject to frequent missed approaches during high-altitude flights. Pilots and aviation authorities should pay significant attention to this issue.

COCKPIT RESOURCE MANAGEMENT (CRM) *(1)

CRM refers to establishing communication between the cockpit and cabin crew, and even during flight monitoring. This means that an experienced pilot must have full situational awareness and use these capabilities effectively to enhance flight safety. Establishing professional and interpersonal communication is essential for proper flight management.

A pilot should possess judgement *(2) to avoid creating risk elements in CRM. Proper decision-making is crucial for conducting safe flights, reviewing past incidents, and learning from them. In different flight situations, pilots should take appropriate actions and avoid reckless decisions. They must demonstrate precision in risk assessment.

Footnotes:
1. Crew Resource Management (CRM): The application of team management concepts in the flight deck environment. It was initially known as cockpit resource management, but as CRM programs evolved to include cabin crews, maintenance personnel, and others, the phrase crew resource management was adopted.
2. Judgement: The mental process of recognizing and analyzing all pertinent information in a particular situation, a rational evaluation of alternative actions in response to it, and a timely decision on which action to take.

In this flight, unfortunately, the co-pilot did not properly manage the situation and failed to communicate effectively with the instructor pilot, who was acting as the Pilot Flying and attempting to assist him.

Furthermore, due to improper planning and lack of knowledge in executing a proper approach procedure, the co-pilot attempted to handle the Pilot Flying role himself. However, his decision-making process was incorrect in certain aspects.

RISK ELEMENTS
1. Pilots must be well-prepared to conduct a flight, including assessing the aircraft's condition, gaining flight experience, and reviewing relevant checklists.
The co-pilot had not adequately evaluated whether he was suitable for the flight.
2. Weather conditions should be carefully considered in terms of wind direction, visibility limitations, and aircraft equipment status.
3. The airport environment should be assessed, including weather reports, runway conditions, and the airport's accessibility.
In this case, the weather conditions and aeronautical reports had warned of certain dangers. The presence of heavy snowfall and moderate icing in the area contributed to the aircraft encountering icing conditions.
4. The primary goal of a flight is to ensure its safe continuation.
A pilot must remain committed to this decision, as it is essential for passenger safety and to prevent physical damage and financial losses.
However, in this case, the co-pilot failed to recognize the difference between these factors and did not properly consider all parameters.
As a result, he created risks that increased the likelihood of an incident occurring.

Conclusion:

A detailed examination of this case revealed numerous flight performance issues related to the co-pilot. However, the main cause of the incident needs further investigation.

2.2 Meteorological Group

The meteorological report for the Boeing 727 flight (registration EP-IRP) from Tehran to Urmia was provided to the flight crew by the dispatcher of the Islamic Republic of Iran Airlines, along with other flight information, in the flight folder dated 10/19/89.

The following information is from the SITA Flight Plan, which is the main flight file.

Working Folder - SUN 09 JAN 11 - Flight Plans

OITR	N3740.3	E04504.2	038.5	0002
UMH	N3741.2	E04505.1	108.6	0064
TOC	N3720.8	E04621.4	109.5	0121
ZAJ	N3646.8	E04821.2	136.5	0025
TULGU	N3628.6	E04842.6	137.1	0119
SAV	N3501.1	E05022.3	160.4	0019
RGVBD	N3443.0	E05030.1	160.6	0036
TOD	N3408.8	E05044.6	160.7	0042
DISEL	N3329.1	E05101.3	137.4	0060
ISN	N3244.8	E05149.7	080.4	0001
OIFM	N3245.1	E05151.8	000.0	0000

PLAN HAS BEEN PREPARED IN ACCORDANCE WITH IRAN-AIR FLIGHT OPERATION POLICY . BEING RELEASED / VALID FOR SIX HOURS AFTER ESTIMATE TIME OF DEPARTURE AND APPROVED BY:

FLIGHT DISPATCHER: CAPTAIN:

RELATIVE FLIGHT DOCUMENTS

1-OFP 3 PAGE/S
2-ATC FLIGHT PLAN AS APPLICABLE - PAGE/S
3-WEATHER X PAGE/S
4-NOTAM 7 PAGE/S
5-MEL ITEMS APPLICABLE ACC TO TECHNICAL LOG

START OF ICAO FLIGHT PLAN

(FPL-IRA277-IS
-B722/M-SDHRW/S
-OIII1230
-N0468F300 PAROT3A PAROT UL125 ZAJ G781 TUBAR TUBAR2A
-OITR0056 OIII OITT
-REG/EPIRP SEL/GJFH
-E/0248 P/TBN R/VE S/M J/L D/04 180 C YELLOW A/BLUE OVER WHITE)

END OF ICAO FLIGHT PLAN

+-+

Reference: DYS87 Page Number : 3

The meteorology team, after being informed of the incident, proceeded to collect the relevant meteorological data from the respective sources as described below.

2. 2. 1 The meteorological information for the departure and destination Airports is as follows:

The present weather report on the day of the accident, according to the official report of the National Meteorological Organization, was as follows:

Present Weather (METAR):

A. Tehran Mehrabad Airport

Time of the Observation	Surface Wind	Surface Wind	Visibility	Present Weather	Cloud	Air and Dew Point Temperature	Pressure Values
UTC	Wind Direction (DEG)	Wind Speed (KT)	M	-	-	Deg(Celsius)	QNH(Hpa)
11:00	60	10	7000	-	FEW035CB SCT040 OVC090	05/M00	1018
11:30	90	8	7000	-	FEW035CB SCT040 OVC090	05/01	1018
12:00	60	8	7000	-	FEW035CB SCT040 OVC090	05/00	1018
12:30	80	10	5000	SHRA	FEW030CB SCT040 OVC090	05/00	1018
13:00	90	10	5000	-RA	FEW035CB SCT040 OVC090	05/00	1018
13:30	100	10	5000	-RA	FEW035CB SCT040 OVC090	05/00	1018
14:00	90	8	5000	HZ	FEW035CB SCT040 OVC100	05/00	1018
14:30	130	8	More than 10km	-	FEW035CB SCT040 OVC100	04/01	1018

15:00	130	8	More than 10km	-	FEW030 FEW035CB SCT040 OVC100	04/00	1018

B: Urmia Airport

Time of Obv.	Surface Wind	Surface Wind	Visibility	Present Weather	Cloud	Air and dew point temp.	Pressure Values
UTC	Wind Direction (DEG)	Wind Speed (KT)	Meter	-	-	DEG (Celsius)	QNH (Hpa)
10:50	350	4	800	SN	SCT015 SCT020 OVC000	01/01	1016
11:50	250	4	800	+SN	SCT015 SCT020 OVC060	01/01	1015
12:50	0	0	700	SN	Same as above	01/00	1015
13:50	290	4	800	+SN	^	00/00	1015
14:50	240	6	800	+SN	^	00/00	1015
15:50	260	4	800	SN	^	00/00	1016
16:50	330	4	600	+SN	^	00/00	1016
18:00	290	4	500	+SN	^	00/00	1016

2.2.2 Forecast (TAF):

Urmia Airport Forecast

This type of forecast specifies the specific weather conditions of an airport within a time frame. This forecast includes information such as the time of issuance, validity period, surface visibility, cloud conditions, and any expected changes.

For Urmia Airport, this forecast was issued at 06:00 UTC on 19/10/89 and is valid from 09:00 UTC on the same day. The wind was reported from 240 degrees at a speed of 15 knots. The actual visibility was 1500 meters due to fog. Additionally, the cloud ceiling was at 2000 feet, with scattered clouds at 900 feet and an overcast sky at 8/8 coverage.

Expected changes:
Visibility was expected to decrease further, reaching 800 meters due to fog. Snowfall was predicted, and cloud coverage was expected to increase, with cloud types as follows:
At 2700 feet: Stratocumulus clouds with 3/8 to 4/8 coverage
At 1500 feet: Cumulonimbus clouds with 2/8 coverage
At 1200 feet: Clouds with 3/8 to 4/8 coverage
At 2500 feet: Clouds with 8/8 coverage

Route Forecast (Rofor):

This type of forecast predicts weather conditions over a region. On the day of the accident, snowfall and rain were predicted for the northwest of the country. Additionally, visibility was expected to be 1500 meters due to fog, with local reductions to 400 meters.

2.2.3 Upper Wind and Temperature Chart:

By reviewing this chart, the following information can be obtained:

At a flight altitude of 34,000 feet (FL340):
Wind speed: approximately 20 knots from the northwest
Temperature: approximately -55°C

At a flight altitude of 30,000 feet (FL300):
Wind speed: approximately 15 knots from the northwest
Temperature: approximately -53°C

At a flight altitude of 24,000 feet (FL240):
Wind speed: approximately 20 knots from the west-northwest
Temperature: approximately -41°C

At a flight altitude of 18,000 feet (FL180):
Wind speed: approximately 15 knots from the southwest
Temperature: approximately -29°C

2.2.4 AIRMET (Aeronautical Meteorological Warnings)

This section includes brief descriptions of meteorological phenomena that occur or are expected to occur along the flight route and could pose a safety risk to the flight.
AIRMET No. 12: Issued at 13:11 UTC and valid from 13:05 UTC to 14:30 UTC
Mentioned the presence of cumulonimbus clouds in hidden formations among other clouds, which were not easily identifiable from the peak height.
Cloud base: 1,500 meters
Actual visibility: 1,800 to 4,000 meters
Cause: snowfall and pollution forecast for Urmia
AIRMET No. 14: Issued at 14:14 UTC and valid until 17:30 UTC
Reiterated the same conditions as AIRMET No. 12.

Significant Weather Chart

This chart indicates that cumulonimbus clouds were present in hidden formations among other clouds at altitudes of 22,000 feet and below.
These conditions were recorded in the northwest of the country (marked as ISOL EMBD CB on the chart).
Snowfall and the extent of cloud cover were also detailed on the chart.

2-5: Meteorological Group Analysis and Evaluation

Based on an assessment of the weather conditions on the day of the incident, the following observations and analysis were made:

A) The weather and atmospheric conditions at Mehrabad Airport from 11:00 to 15:00 UTC were considered suitable for flight.

B) The weather and atmospheric conditions at Urmia Airport from 10:50 to 11:50 UTC provided suitable visibility for flight operations. However, visibility slightly decreased by 12:50 UTC but then improved again between 13:50 and 15:50 UTC, making flight operations possible. Additionally, from a turbulence perspective, flying conditions were favorable.

C) The TAF forecast for Urmia Airport, issued at 06:20 UTC, predicted suitable flight conditions.

2.2.6 Conclusion of the Meteorological Group

Following a thorough review of meteorological reports, flight difficulties, and additional information gathered from the National Meteorological Organization, the following conclusions were drawn:
1. Wind speed and direction changes were observed in the vertical axis and along the runway axis at the airport, as well as in its surrounding areas. This suggests the possible presence of wind shear in certain locations.
2. Temperature inversion was weak, but its absence does not rule out the occurrence of temperature inversion.
3. There were no reports indicating the presence of freezing rain or freezing drizzle.
4. The prepared soundings did not show significant convective currents in the airport's vicinity.
5. Given the existing cloud cover and snowfall, icing (the formation of ice on aircraft surfaces) was expected to be light to moderate.

2.2.7 Meteorological Abbreviations and Terms

Some of the symbols and abbreviations are as follows:
- In the current weather column, the symbols "+" and "-" indicate the intensity of the phenomenon or its proximity to the airport.
- The negative sign (-) indicates a light phenomenon.
- The positive sign (+) indicates a heavy phenomenon.
- SH stands for showers, RA for rain, SN for snow, and HZ for haze.

In the cloud column, the following definitions are used:
- FEW means that the sky is partly cloudy (1 to 2 octas).
- SCT means that the sky is scattered with clouds (3 to 4 octas).
- BKN means that the sky is broken with clouds (5 to 7 octas).
- OVC means that the sky is overcast (8 octas).

The numbers following the terms FEW, SCT, BKN, and OVC indicate the height of the cloud base in feet above ground level.
- CB stands for Cumulonimbus cloud.

When the temperature and dew point values are equal in the temperature and dew point column, the relative humidity is 100%, indicating conditions favorable for fog formation.

2.3 Air Traffic Service Group

2.3.1 Flight Description: IRA277

- Flight IRA277, registered as EP-IRP, operated by the Islamic Republic of Iran Airlines (B727), was scheduled to depart from Mehrabad International Airport after necessary coordination with air traffic control units at 1503 UTC.
- The flight was authorized to proceed to its destination, Oroumieh Airport, at an altitude of 30,000 feet.
- The flight continued under the guidance of Mehrabad air traffic control units and the national airspace control administration.
- At 1537 UTC, the flight was cleared to descend to 14,000 feet and was handed over to Urmia Airport.
- At 154053 UTC, Flight IRA277 contacted Urmia Tower, received meteorological and airport information, and was cleared for the ILS approach on Runway 21 via the TUBAR 2A arrival procedure. The flight was also informed about the runway condition regarding snow and braking action.
- At 154425 UTC, the flight reported passing 13,000 feet and subsequently reported its position at the TUBAR fix as requested by the tower controller.
- At 154753 UTC, the flight reported its position at the TUBAR fix at 13,000 feet and was cleared for the approach. The controller requested a position report at the IAF (Initial Approach Fix).
- At 155011 UTC, the flight reported leaving the IAF and was instructed by the controller to establish on the ILS for Runway 21.
- At 155449 UTC, the tower controller requested the flight's position, and the flight reported its position at 5 miles. The controller then inquired if the flight had established on the ILS, to which the flight responded negatively.
- The tower controller confirmed the continuation of the approach and asked if the flight intended to land. In response, Flight IRA277 stated that it had aborted the approach and was executing a missed approach. The controller acknowledged this and instructed the flight to report leaving the IAF for Runway 21.
- At 160053 UTC, the tower controller inquired about the flight's position, and the flight reported being on standby. The controller then asked about the flight's intentions, and the flight responded that it was aborting the approach due to intermittent radio communication issues.
- The tower controller requested a repeat of the last communication, and the flight stated, "We are going to Tehran."
- At 160146 UTC, the tower controller informed Flight IRA277 that its altitude appeared to be below the minimum allowed.
- Between 160216 UTC and 160516 UTC, the tower controller attempted to contact the flight eight times but received no response.

Analysis of Air Traffic Control Unit Performance:

- Initially, the flight plan for IRA277 was scheduled for 1230 UTC, but it was revised to 1415 UTC and finally set for 1445 UTC after necessary coordination between various departments. The flight departed at 1503 UTC under the supervision of the General Department of Air Traffic Control.
- At 150349 UTC, the flight contacted the Approach Radar Unit at Mehrabad Airport and, after identification, was cleared to climb to an initial altitude of 16,000 feet, eventually reaching 30,000 feet.

- At 151405 UTC, the flight was cleared to leave the Approach Radar frequency and contact the Area Control Center.
- At 151432 UTC, Flight IRA277 contacted the Area Control Center and reported climbing to 32,000 feet. The flight was identified by the radar controller.
- Before reaching the Zanjan position, the flight requested a direct route to the TUBAR fix, which was denied due to deviation from the designated air route.
- At 1537 UTC, the flight was cleared to descend to 14,000 feet. After the pilot reported establishing radio contact with the destination airport, the flight was cleared to leave the Area Control frequency at 1542 UTC.
- At 154053 UTC, the flight contacted Urmia Tower and was cleared for the ILS approach on Runway 21, with a reported visibility of 2,222 meters (which was accurate).
- Based on the playback of the radar track, it appears that the flight was maneuvering to intercept the ILS, but the pilot reported being approximately 5 miles to the left of the intended path. The pilot then declared an aborted approach.
- At 160053 UTC, after follow-up by UrmiaTower, the pilot stated, “We are going to Tehran.” At this point, the tower controller noted the inappropriate altitude of the flight.
- Despite repeated attempts by Urmia Tower to contact the flight, no response was received. After several maneuvers, the flight disappeared from radar at approximately 22 miles from the airport.

Additional Notes:

- According to ICAO Document 4444, Section 2511, there are no predefined instructions for radio communications during abnormal conditions due to the unpredictable nature of emergencies. Therefore, the continuity of control communications is emphasized due to its importance.

Performance of Air Traffic Control Units and Aviation Equipment

- Despite the flight crew not providing any information about unfavorable flight conditions, the communications between the crew and air traffic control were not related to the occurrence of the accident.
- With reference to the aviation circular AIC 7/08 dated May 1, 2008, regarding AMD and its use, the points mentioned in the circular were applied as much as possible by the Urmia Airport controller.

2.3.2 Review of ANS Equipment Performance

- The performance of the aviation equipment at Urmia Airport on the day of the incident was as follows:
  - The ILS, VOR, DME, and NDB equipment were functioning properly, as per the operational statistics of Urmia Airport for the month of Dey 1389 (December 2010 - January 2011).
  - The equipment was checked by the Flight Check aircraft on December 28, 2010 (07/10/89) and remained valid until June 28, 2011 (07/04/90).
  - The ATIS and tower frequencies at Urmia Airport were also functioning properly.

2.3.3 Conclusion on Air Traffic Control Unit Performance

- The performance of the air traffic control units was in accordance with regulations and procedures. Necessary coordination for controlling and guiding the flight was carried out correctly, and additional efforts were made to obtain information about the aircraft's status during the flight. It is important to note that the flight crew did not report any technical or operational issues to the air traffic control units.

Witness Statement Group Report 2.4

2.4.1 Actions Taken by the Group

- Immediately after the accident involving the Boeing 727 registered as EP-IRP, operated by the Islamic Republic of Iran Airlines, near Urmia Airport, the witness statement group was formed. The group was dispatched to the accident site near Urmia Airport, and the relevant activities began. The detailed actions taken include:

Interviews with

Eyewitnesses and Information Collected from Injured Passengers and Local Residents

1. Interview with a Male Passenger (Hospitalized):
   - The passenger, seated in row 12E, was interviewed while hospitalized due to injuries sustained in the accident. He stated that during the approach to Urmia Airport, the weather was unfavorable. The pilot announced that passengers should keep their seatbelts fastened for landing. At this time, the aircraft experienced turbulence. Due to the inability to land, the aircraft circled once or twice, and turbulence occurred again. Eventually, the aircraft collided with the ground.
   - The passenger also mentioned that a relative, who owns a fish farm near the airport, observed sparks coming from the aircraft, though the exact source of the sparks was unclear.

2. Interview with a Female Passenger (Hospitalized):
   - The passenger, seated in seat 5E, was interviewed while hospitalized. She stated that during the approach to Urmia Airport, the aircraft descended to land, entered clouds, and experienced turbulence. The aircraft was unable to land at the airport and ultimately collided with the ground.

3. Interview with a Local Male Resident:
   - The interviewee, a high school graduate and local resident near Urmia Airport, works as a horse breeder in the area. He reported seeing the aircraft at an altitude of approximately 200 meters above the ground. He observed the aircraft moving away from him and then turning back toward him. He felt that the aircraft was attempting to approach the airport for landing. Additionally, he noticed that the aircraft's lights momentarily turned off and then back on.

4. Interview with a Female Flight Attendant:
   - The flight attendant, who was injured in the accident, was interviewed after her recovery. She stated that she does not remember precise details of the accident but mentioned that she was working in the rear galley (Galley 6) of the aircraft during the flight.

Continuation of Witness Statements and Findings

- The flight was delayed by approximately one and a half hours. Passengers were informed that the weather in Urmia was very unfavorable, and the flight might be canceled. However, the flight eventually departed with a delay of one and a half hours. During the flight, everything seemed normal, and there were no significant issues.
- During the descent and landing phase, a passenger, in a state of panic, called the flight attendant and expressed concern that the aircraft's engine was sparking. The flight attendant observed sparks coming from engines 1, 2, and 3. The last thing the flight attendant remembers is reassuring the passenger that it was not a major issue. She only recalls this moment clearly.

5. Interview with a Flight Security Officer (ACM):
   - The flight security officer, who was severely injured in the accident, was interviewed. His statements are summarized as follows:
     - The flight was initially delayed due to a technical issue, which was resolved after the technical team intervened. Passengers were informed that the weather at the destination was unfavorable. The officer was seated in seat IC.
     - After takeoff and approaching the destination, the weather was extremely poor, with heavy snow and fog, making it impossible to see outside through the windows. The flight duration was longer than usual.
     - The aircraft appeared to be circling again for landing when initial turbulence began. After a few seconds, the shaking intensified, making it difficult for the officer to move to the rear of the aircraft.
     - The aircraft's power went out, and everything became completely dark. The officer lost consciousness and, upon regaining consciousness, found himself among the wreckage of the aircraft in cold, dark conditions.
     - The first responders to the accident site were local villagers and Urmia Airport personnel, followed by rescue teams. The officer was transported to the hospital in an ambulance without proper medical equipment or a nurse. The ambulance was not equipped with medical supplies or safety equipment.

2.4.2 Conclusion of the Eyewitness Group

- The weather conditions at the time were severe, with heavy snow and fog.
- The aircraft entered a missed approach state and attempted to return for landing.
- The cabin lights turned off and then came back on.
- The aircraft experienced severe turbulence.

2.5 Report of the Flight Data Recorders Group:

(Flight Data Recorders Group)

After the occurrence of this accident, the investigation team was dispatched to the crash site and proceeded to locate the FDR & CVR devices. The location of these devices is in the rear section of the aircraft, near the emergency exits. Since this part of the aircraft (Tail) was completely separated from the fuselage, the devices were found along with this section next to the wreckage of the aircraft. Fortunately, these devices were intact and undamaged, as this section did not experience severe impact.

The devices were safely located in their designated compartments, which remained intact in the rear wall of the compartment. They were immediately identified and, with coordination from the Red Crescent personnel and the use of hydraulic shears, were easily accessed. They were retrieved by a member of the investigation team from aircraft B.727, registration EP-IRP, and handed over to the accident investigation team.

2.5.1 Cockpit Voice Recorder (CVR)

A: This CVR is of the magnetic tape CVR type, which has the capability to record the last 30 minutes of flight conversations. Initially, this device was examined for playback in the Radio Shop section of Aseman Airlines. A CD containing the recorded conversations was taken, and the team investigating the accident received a copy.

To obtain higher-quality audio files and ensure better synchronization with the FDR device, the accident investigation team decided to conduct further analysis with the FDR device. The person responsible for the investigation took the FDR along with the CVR to the BEA (Bureau of Enquiry and Analysis for Civil Aviation Safety) in France for playback.

Therefore, to facilitate this process, the device had to be analyzed in the presence of representatives from Iran's Aircraft Accident Investigation Team, the Islamic Consultative Assembly (Parliament) of Iran, and the Civil Aviation Organization of Iran. The playback took place at BEA's laboratory on 15 February 2011 (26/11/1389 in the Iranian calendar).

According to the playback procedure, the CVR was connected directly to the playback device in the Radio Shop of Aseman Airlines. The total recorded duration in the CVR was 27 minutes, but it did not include the conversations at the time of the accident.

Following the playback instructions at BEA, the device was first examined by experts, who noticed that it had suffered some damage due to impact. Some of the Header tape had been compressed. By carefully extracting the magnetic tape memory, the playback was conducted, revealing that the actual recorded conversation duration was approximately 37 minutes and 31 seconds.

B: CVR Device Specifications
- Make: Fairchild
- Type: CVR
- Part Number: A.100
- Serial Number: 3185

The type of CVR has a magnetic tape with a recording of about 30 minutes.

Information recorded on the 5 tracks of the CVR is as follows:
- Track 1: ATC communications – 0.5 hour – 16 KHz
- Track 2: Public address – 0.5 hour – 8 KHz
- Track 3: Cockpit Area Microphone (CAM) – 0.5 hour – 8 KHz
- Track 4: ATIS – 0.5 hour – 8 KHz

C: Fortunately, the CVR playback was successful, and 37 minutes and 31 seconds of the last cockpit conversations were recovered. These conversations included the final moments before the accident, from approximately the time the aircraft was approaching the airport. A detailed transcript is provided below.

Note: Before I begin with the translation of the CVR Data, I'd like to point out, that it's very likely the Co-Pilot was a so called "Hezbollahi". This term hasn't got anything to do with the Terror Organization Hezbollah, but more so with the fact, that He and his family were big Regime Supporters, possibly with high ranks in Government and Military. As corruption in Iran is high, it's likely the Co-Pilot got his Position due to corruption, and not because he necessarily wanted it, or had any experience. This is verifiable through his name, his rapid ascent to a Flying Pilot at Iran Air and the following CVR data, showing "slight" incompetence, aswell as lacking communication with the other two Pilots.
This isn't proved or talked about at all in this report, so do take this with a grain of salt, but the likelihood that this is the case, or that Iran Air in general hires pilots due to ranks in Government (meaning corruption) is very much there. Thank you.

CVR REPORT OF A B727 AIRCRAFT WITH THE FLIGHTNUMBER IRA 277|LEADING TO ACCIDENT

Time (in UTC)	CVR Related Time	Speaker	Transcript of the Conversation
15:31:13	00:05	FE	Look, my eyeball was loose.
15:31:24	00:11	FO	Man, props to you, you aren't a lawyer your a engineer, yeah? No, you aren't a lawyer but still. From a Human perspective everything is possible.
15:31:43	00:30	FE	If we return to Tehran, I'll give them all three of these Seat Belts to change out for new seat belts.
15:31:50	00:37	FE	It's like they weren't in the Inspector Shop.
15:31:52	00:39	FO	Talk about an inspector.
15:31:56	00:43	FO	Now we're gonna get that Son of a whore [fired]- the Inspector.
15:31:57	00:44	FO	The inspector…
15:31:58	00:45	FE	God kill the inspector that allowed these [seatbelts] to release.
15:31:59	00:46	FO	Talk about an inspector!
15:32:21	02:08	FE	You know they can't paint it.
15:32:27	02:14	PIC	Why?

15:32:31	02:18	FE	Colored white or white… these people, regardless of its/their color cannot learn.
15:32:38	02:25	FO	Exactly.
15:32:40	02:27	PIC	Exactly.
15:32:55	02:42	FE	Every Task has its delicacy. If your hand moves or shifts even a little, it'll make a huge difference.
15:33:10	02:57	FO	Yes, Sir, I agree. It's not like I don't know anything at all now.
15:33:26	03:13	FO	Okay it's giving us the VOR. I'll set the ATIS to 1 and see if there's any news.
15:33:50	03:37	FO	Is anything coming through now? Or should we go ahead? (Referring to receiving the ATIS Signal)
15:34:03	03:50	FO	But we came in nicely.
15:34:25	04:12	FO	Engineer, when did you go to the simulator last time? We went together last time. Did you go ahead? Were you early?
15:34:33	04:20	FE	No way man! Six months ago… there was that simulator that had absolutely no value and no effect.
15:35:06	04:53	PIC	Well had it also received the AIRAC update? (Referring to the information in the GPS device?)
15:35:08	04:55	FO	Approach?*
15:35:09	04:56	PIC	Didn't you give it?
15:35:10	04:57	FO	It means me giving him a Point.
15:35:12	04:59	PIC	Ask him for approach, hurry up already
15:35:16	05:03	FO	You sure?
15:35:17	05:04	PIC	Yes (passive aggressive tone)

15:35:18	05:05	FO	Clear it for Delta Delta
15:35:19	05:06	PIC	When does the approach moment come? Look it up.
15:35:21	05:08	PIC	Thank you… no.
15:35:27	05:14	PIC	Reza, take this thing here, give it to Mr. Mortazavi
15:35:32	05:19	PIC	Mr Ghaffari will you do the honor?
15:35:33	05:20	FE	No problem.
15:35:34	05:21	FE	What’s your name?
15:35:35	05:22	FA	Mahdi.
15:35:36	05:23	PIC	Mahdi, good boy.
15:35:37	05:24	FA	I’m at your service.
15:35:38	05:25	FE	Thank you.
15:35:39	05:26	FA	No problem.
15:35:40	05:27	FO	So we’re gonna go fast from here on now?
15:35:44	05:30	PIC	After the STAR
15:35:51	05:31	PIC	We have to pull it out
15:35:52	05:38	FO	Is that VOR?
15:35:54	05:39	PIC	Yes, we’re in STAR
15:35:55	05:41	PIC	It had STAR
15:35:56	05:42	FO	It didn’t
15:35:57	05:43	PIC	It didn’t, I gave it tho, look now
15:36:04	05:44	PIC	Man, let’s give them our Approach and go
15:36:07	05:51	PIC	Give them this: VOR/DME/ILS 1/21
15:36:13	05:54	PIC	Yeah?
15:36:14	06:00	FO	Yes
15:36:15	06:01	PIC	I don’t know, it might not have it (referring to GPS)
15:36:17	06:02	PIC	It’ll be clear now
15:36:19	06:04	PIC	Does it have that Approach? Let me see

15:36:22	06:06	PIC	No it doesn’t have it
15:36:23	06:09	FO	And if it had it captain?
15:36:26	06:10	PIC	We don’t have it, but it’s not like we can approach now
15:36:29	06:13	FO	We‘ll give it to them, but we‘ll control it
15:36:45	06:16	FO	Both VHF NAV Urumiye set and identified
15:36:48	06:32	PIC	95
15:36:50	06:35	PIC	Let’s go down slowly… are you okay with that?
15:36:51	06:37	FO	Yes sir, keep 95 (95 nautical miles to descend to Urumiye)
15:36:52	06:38	FO	Is this Urumiye
15:37:07	06:39	PIC	We probably have to get anti ice, but we have it
15:37:08	06:44	PIC	Make it a little warmer
15:37:15	06:54	ACC	Tehran IRA 277 requesting descend
15:37:19	06:55	PIC	Iran air 277 descend FL 140
15:37:24	07:11	PIC	Descend
15:37:56	07:43	PIC	We‘re on course, ILS 9, 108 inbound 209 NDB FRQ 370 DH 240 Arc 11 DME, look if you continue with lead radial, You don’t need to turn, just continue FO: Yes
15:37:57	07:44	FO	40 seconds
15:37:57	07:46	PIC	I will wait..
15:37:59	07:50	PIC	Just continue with that heading
15:38:03	07:51	PIC	If I continue it’ll correct itself to 11
15:38:04	07:52	PIC	Yes, yes
15:38:05	07:54	PIC	No problem if you wanna wait
15:38:07	07:55	FO	Yes yes

15:38:08	07:56	FO	Lead Radial 225
15:38:09	From this point I believe leaving the time of recording out is the smarter thing to do. The times given in the report are completely wrong, while the UTC time is correct. If one wants to find out the correct time, they just have to start from 15:31:13 UTC and do a bit of addition.	FO	I'll try to keep the flaps non retracted before lead radial
15:38:14		PIC	If we stop, we'll be too slow (?)
15:38:17		FO	Let's stop?
15:38:18		PIC	Okay, until intial, flap 25
15:38:20		FO	Yes
15:38:24		PIC	Alright, don't worry
15:38:39		PIC	*sounds of humming*
15:38:42		ATIS	INFORMATION D TIME 152500: RWY 21 for arrival RWY 03 for departure, expect VOR / DME/ ILS approach 21, Transition Level 110, Wind 240 deg 6 knot, Visibility 800 meters, Weather heavy snow, SCT cloud 1500 ft, SCT cloud 2000 ft
15:40:24		PIC	We don't need to know the weather.
15:40:26		FE	Ok
15:40:43		-	*sound of throttle*
15:40:46		PIC	I'll talk with radio number 2
15:40:49		PIC	Tower Urumiye

15:40:55		PIC	Good evening Urumiye IRA 277
15:41:01		PIC	Try and get it down faster
15:41:02		TWR	IRA 277 Urumiye tower good evening
15:41:02		FO	I understood
15:41:05		PIC	Released by Tehran Sir,63 DME, Out Of 250 Descending 140 Released By Tehran, B, 10 .... 15 IRA 277
15:41:15		FE	15
15:41:16		PIC	15
15:41:17		TWR	IRA 277 Latest Information F QNH 1015, Expect For VOR DME ILS1 APP RWY 21 Via TUBAR 2A Descend FL 130 Report TUBAR
15:41:32		PIC	Roger, Position TUBAR descending 130 for VOR/DME/ILS 1 via TUBAR 2 A, IRA 277
15:41:42		TWR	Homa 277, Tower
15:41:47		TWR	Good day, I'm reading the SNOTAM for you. 5 meter slush around center slush, braking effiency medium. 5 meters after center line snow, 5 mm.
15:42:21		FO + TWR	Should I turn off engine 2? TWR: Thank you copy.
15:42:22		PIC	No problem

15:42:28		PIC	If there’s 5 mm snow, there’s gonna be problems taking off.
15:42:36		FO	Is 5 mm 2 inch?
15:42:39		PIC	Obviously, what did you think
15:42:40		FE	No
15:42:46		FO	Not translatable, some stupid comment about height conversion
15:42:47		FE	13-9 mm snow could cover the runway.
15:42:59		PIC	Approaching position ROVON contact with destination Urumiye, IRA 277
15:43:00		ACC	IRA 277 stand by for frequency change
15:43:11		PIC	Standing by IRA 277
15:43:15		FO	130, 140
15:43:23		PIC	We have the icing till next week
15:43:25		PIC	Engineer, turn on the seat belts, prepare for approach
15:43:27		FE	Yes sir
15:43:36		FE	The approach is gonna be hard for the passengers because of the weather, but I told them that already
15:43:40		PIC	No, not a problem
15:43:49		PIC	We have to get to 13.000 in 3 minutes
15:44:16		PIC	Quickly.
15:44:18		FO	Yes
15:44:19		ACC	IRA 277 Radar service terminated continue with Urumiye frequency 118.25 happy landing good bye
15:44:26		PIC	Changing 25 IRA 277 bye

15:44:35		PIC	Hello again, Urumiye IRA 277 released by Tehran, out of 146 descending 130
15:44:44		PIC	Put the speed brakes on
15:44:45		TWR	Roger . IRA 277, Report Position TUBAR
15:44:46		FE	Roger
15:44:50		PIC	Call you Position TUBAR IRA 277
15:44:53		-	Attitude alert
15:44:59		PIC	Close 31 and 8
15:45:04		PIC	*sound*
15:45:22		PIC+ -	PIC: Anti-ice open please *sound of anti ice*
15:45:27		FE	Anti ice on
15:45:31		FE	Should I hold N1 at 55%?
15:45:34		PIC	Yes my love
15:45:37		FE	It got really warm, really warm
15:45:39		FA	Captain, Service ended
15:45:41		PIC	Thank you, thank you
15:45:59		PIC	After TUBAR we can descend to 9000 ft.
15:46:02		FO	Yes
15:46:06		FE	Dispatch Urumiye, Hello, good night, Homa (IRA) 277.
15:46:11		DISPATCH	Homa (IRA) 277, dispatch, good day
15:46:15		FE	We’re landing in like 10 minutes, please hold the fuel at 25
15:46:23		DISPATCH	25.000 point, what should I hold the trip too?
15:46:28		FE	Set the Trip to 10000
15:46:39		DISPATCH	Thank you sir, have a good landing.
15:46:41		FE	Im thankful to all of you.

15:46:47		PIC	Those 10000 are excellent
15:46:49		FE	Thank you my love (jokingly)
15:46:35 (?)		FE	I am thankful for you
15:46:36		FE	8280, not more than that
15:46:37		FE	No
15:46:41		FE	If you get out 25 fuel that's good
15:46:43		PIC	Yes excellent, all LEGS 25
15:46:46		FE	Yes
15:46:55		PIC	*sound*
15:46:58		FE	Yes, 2800 is fine.
15:47:19		PIC	1015 (QNH)
15:47:22		FO	1015
15:47:28		PIC	Descend and APP check list
15:47:29		FE	Seat Belt- On
15:47:30		FE	Anti-ice
15:47:32		FO	Open
15:47:33		FE	Landing light
15:47:34		FO	On
15:47:35		FE	Altimeter
15:47:36		FO	1015 set and cross checked
15:47:38		PIC	1015 set and cross checked
15:47:41		FE	Radio altimeter
15:47:42		FO	Minimum 300..
15:47:44		PIC	Minimum 240 that
15:47:50		FE	Flight instruments, FDs, Radio
15:47:52		FO	Set & cross check
15:47:54		PIC	Cross checked
15:47:55		FE	Go around EPR and V-REF

15:47:56		PIC	Go down and don't wait
15:47:57		FO	BUGS SET
15:47:58		PIC	Tubar
15:47:59		FO	Yes, tubar
15:48:01		FO	5000
15:48:02		PIC	Position TUBAR 130 descending IRA 277
15:48:07		TWR+FE	IRA 277 cleared approach report passing intial approach fix (IAF)
15:48:12		FE	Fuel set for landing. (Checklist is being read) Hydraulics-Pressure and Quantity normal
15:48:14		PIC	Call you passing intial approach fix
15:48:15		FE	Pressurization & cooling doors set
15:48:20		FE	Circuits breakers checked
15:48:21		FO	GPS- NAV GREEN
15:48:23		PIC	TO GO
15:48:29		-	*sound of switches being turned*
15:48:30		PIC	Sound of [inaudible]
15:48:37		-	sound of a *boop*
15:48:39		PIC	These 3 pills fucked your thoughts up.
15:48:40		FO	I eat 3 […] a day.
15:48:41		PIC	That's way too much.
15:49:23		PIC+FO	PIC: If we bring it down, actually no keep it, bring the flaps … intial … [inaudible] (?) FO: Is the speed accordingly okay for the flaps?
15:49:30		PIC	Hold on the Anti Ice.
15:49:33		PIC	Engineer will bring the engine down as much is possible. So probably N1 55%

15:49:39		FO	Ok.
15:49:52		PIC	Reza,forget the heading , we'll continue later, if necessary , override the NAV, if needed override!
15:50:07		FO	GPS-NAV
15:50:08		FO	Flaps 2-please
15:50:10		FE	Descend approach check list complete
15:50:13		PIC	Leaving intial approach fix IRA 277
15:50:17		TWR	IRA 277 report established, ILS IRA 277
15:50:25		PIC	Call you establish ILS 21 IRA 277
15:50:26		PIC	Turn at 7300 ft
15:50:29		PIC	7300 is actually too much
15:50:29		PIC	Can you hold it at 7300?
15:50:29		FO	Flaps 5 please
15:50:32		PIC	Flaps moving 5.
15:50:42		PIC	We didn't change the heading, it did that by itself, watch the VOR needle.
15:50:49		FO	Then we need to compare them, because-
15:50:53		PIC	Theres no need for now.
15:51:03		PIC	I'll set the ILS for you, so that you put the inbound course 209
15:51:07		FO	Yes
15:51:09		PIC	Yes, go on the NDB
15:51:16		PIC	Yeah, we don't have anything to do with the VOR
15:51:19		FO	we have only 11 for arc
15:51:21		PIC	I'll do that for you. I'll hold the 11 arc.

15:51:31		FE	Bring the power down. Even though it's frozen, we have no other choice .
15:51:33		PIC	Now..
15:51:39		-	*sounds of key being used*
15:51:51		PIC	1000 ft.
15:52:14		PIC	Now we're 11 DME. Watch the course
15:52:16		FO	Yes
15:52:18		PIC	Now your on the arc of 11 DME
15:52:21		PIC	I told you, I wish you hadn't used the wrong heading
15:52:22		FO	Do you want to check it? Sorry. SET ILS
15:52:23		PIC	Do you know it's because now…
15:52:36		PIC	Did you pull it out?
15:52:38		FO	Yes, I did.
15:52:42		FO	Aha, GPS?
15:52:46		PIC	Look for what happend
15:52:54		PIC	Do you see? It's going too quickly.
15:52:55		FO	I didn't use the speed brakes though.
15:52:58		PIC	No problem.
15:53:03		PIC	Flap setting fifteen (15)
15:53:11		PIC	Hold this after 7300
15:53:15		FE	Reza, hold it.
15:53:17		PIC	What's your Radial? Lead radial is 250, I'm saying hold 250.
15:53:24		-	*sound of stick shaker*
15:53:26		PIC	Power, power, power
15:53:30		PIC	Put the throttle lever up fully
15:53:31		FE	Do we have power?

15:53:36		FE	Get the power up
15:53:37		PIC	No, don’t get the power up.
15:53:39		-	*stick shaker*
15:53:40		FO	………
15:53:43		EGPWS	TWENTY FIVE HUNDRED
15:53:44		PIC	No problem.
15:53:45		-	*stick shaker*
15:53:57		PIC	Just be careful about the speed
15:53:59		FO	OK
15:54:05		PIC	Go down, and continue with my heading
15:54:11		FO	Yes
15:54:12		FO	Should I use the ILS frequency?
15:54:21		FO	Should I disarm the autopilot?
15:54:24		PIC	Stand by please
15:54:25		-	*sounds of a key being used*
15:54:28		PIC	What happend?
15:54:30		FO	It Isnt going down.
15:54:31		PIC	Give me a second.
15:54:42		FO	Didn’t I get the glide slope?
15:54:44		FO	Now I have the glide slope.
15:54:45		PIC	Did you get it?
15:54:46		FO	Yes
15:54:47		PIC	No you didn’t get the glide slope, you got the localizer.
15:54:48		FE	We are descending!!
15:54:49		PIC	Landing gear down please.
15:54:50		FO	Yes.

15:54:51		PIC	I'll do it all (PIC becomes PIF and takes control)
15:54:52		TWR	IRA 277 Position?
15:54:56		FO	He wants our DME
15:54:58		PIC	Yeah
15:55:00		FO	What do I say?
15:55:02		PIC	5-6 DME, say 5 DME
15:55:02		TWR	IRA 277, Urumiye Tower Position? IRA 277 position
15:55:05		FO	5 DME inbound Urumiye
15:55:08		TWR	IRA 277, Position?
15:55:10		FE	Speed Speed
15:55:13		FO	Speed Speed
15:55:14		PIC	No, allow it, the speed is okay, there's no problem
15:55:15		PIC	Say 5 DME.
15:55:16		FO	5 DME IRA 277
15:55:21		EGPWS	TWENTY FIVE HUNDRED
15:55:26		EGPWS	Sink rate, sink rate
15:55:27		TWR	Roger IRA 277 confirm continue for landing
15:55:28		PIC	Negative
15:55:31		FO	Negative IRA 277
15:55:39		PIC	Put made miss approach
15:55:42		FO	Make a miss approach IRA 277
15:55:46		TWR	Roger Report joining intial approach fix
		FO	Captain
15:55:49		PIC	Let's see
15:55:51		FO	Call you back when joining intial approach fix IRA277
15:55:55		FO	we don't have VOR!
15:55:56		PIC	No.

15:55:57		PIC	Do we go 150? Course 150
15:56:00		FO	Yes
15:56:01		FE	Read the exact missed approach checklist.
15:56:04		FO	Missed approach procedure, turn left, intercept, radial 150.
15:56:10		PIC	Landing gears up please.
15:56:13		FO	We can put the flaps up one step.
15:56:16		PIC	No, let the flaps stay there.
15:56:21		FO	And intercept radial 150 climbing to 7000
15:56:24		PIC	Flap 5 please
15:56:26		FO	Flap 5
15:56:27		FE	What altitude do we have to go
15:56:30		PIC	Let's go for 7000 then 9000
15:56:38		FE	A mountain is in front of us
15:56:40		FO	There's a mountain, but (inaudible)
15:56:42		FE	Go up.
15:56:49		FE	Landing Gear UP.
15:56:56		PIC	The VOR is 100 and what?
15:56:59		FO	113.5
15:57:01		PIC	Set it to 113.5 .
15:57:07		FO	113.5 correct?
15:57:11		PIC	113.5 went? Wow
15:57:20		PIC	Alright then we‘ll get 150. Isn't 150 there?
15:57:25		FO	Okay, 150.
15:57:27		PIC	We‘ll get 150, get to the altitude and then see.
15:57:28		PIC	SEVEN then 9000 ft.

15:57:29		FO	Thanks
15:57:30		FO	Roger.
15:57:40		FE	Let's try and not retract the flaps.
15:57:43		PIC	No problem.
15:57:44		FE	The anti ice could have freezen, don't retract the flaps.
15:57:54		PIC	It won't freeze at the speed we're going.
15:57:59		PIC	What's our radial? 100 what?
15:58:00		FO	Radial 140, 10 Till 150
15:58:08		PIC	Put it for 9000 ft.
15:58:11		FO	Yes.
15:58:12		PIC	7300 for intial, I don't have intial.
15:58:13		FO	It wasn't 7000, I don't have 9000 captain.
15:58:16		PIC	No 7300 is fine. Seven and-
15:58:19		FO	7000 confirmed captain.
15:58:23		PIC	What's the DME for radial 150?
15:58:26		FO	No DME.
15:58:27		PIC	No DME? No problem.
15:58:30		FO	Turning 150.
15:58:36		FO	Has the altitude increased too much? For me it's 9000.
15:58:40		PIC	25, no the same 1000…. Alright let me see.
15:58:43		PIC	7300 then.
15:58:47		PIC	095, let's see how many DME it is… 11 DME, 8 DME before…
15:58:57		PIC	Okay 9000, we are climbing.
15:59:16		FO	Captain I-
15:59:27		PIC	Okay, radial 275

15:59:29		FO	I have set 275. I set 275 for initial.
15:59:44		FO	Now the DME is increasing.
15:59:48		FO	14 DME
16:00:20		PIC	Don't we have to go Radial 275? Won't that be outbound 095?
16:00:27		FO	Outbound 095
16:00:29		PIC	Set it to 095 outbound, it'll be 95
16:00:37		FO	95
16:00:43		PIC	(Sound of stick shaker)
16:00:45		PIC	Because!
16:00:50		PIC	Power, power!
16:00:51		FO	Yes
16:00:52		FE	Should I go around?
16:00:53		FE	Go till Go Around
16:00:57		TWR	IRA 277 Position
16:00:59		FO	He wants our position captain.
16:01:00		PIC	Stand by please
16:01:02		FO	Stand by please IRA 277
16:01:05		PIC	This because of that thing.
16:01:06		TWR	IRA277 Intention
16:01:07		PIC	Increase power!
16:01:08		PIC	Make a go around!
16:01:09		FO	Make a go around IRA 277 *****
16:01:13		FE	2 engines are gone!
16:01:14		FO	No way
16:01:14		TWR	Again IRA 277 read you in and out would you say again
16:01:15		FE	Yes

16:01:16		FO	Should I retract the flaps?
16:01:19		PIC	We make a go to Tehran
16:01:21		-	*sounds of the engines relighting start at this point and will continue unsuccessfully until the end of the recording*
16:01:21		PIC	Go To Tehran IRA 277
16:01:23		EGPWS	Two Thousand Five Hundred
16:01:27		PIC	2 engines are gone??
16:01:30		PIC	Fuck man! Are you relighting the Engines?
16:01:30		EGPWS	Sink rate, sink rate!
16:01:31		FE	I am relighting 1!
16:01:32		FO	Should I retract the flaps?
16:01:33		PIC	No, do not retract them!
16:01:34		EGPWS	Pull Up!
16:01:41		PIC+ EGPWS	…Retract the Flaps, retract the flaps!! (Pull up!)
16:01:42		FO + EGPWS	I retracted them!! (Pull up!)
16:01:45		FE + EGPWS	I'm relighting number 1!! (Pull up!)
16:01:47		PIC + EGPWS	Relight number 1 quickly!!!! (Pull up!)
16:01:49		FO + EGPWS	Oh wow we're going down badly! (Pull Up!)
16:01:50		-	*sounds of engine 1 restarting can be heard until the end of the recording*
16:01:50		PIC + EGPWS	WE'RE DONE FOR!! (Pull Up!)
16:01:50		TWR	IR 277- *unfinished message by Tower, recording cuts off as the plane impacts the ground.

2.5.2 Flight Data Recorder (FDR):

A:

Initially, this file was read at the Radio Shop section of the airline company (Tasan) and was retrieved using the Down Load method, following which the Data Frame from the Boeing 727 aircraft was analyzed. However, due to the absence of an FDAU (Flight Data Acquisition Unit) in the aircraft structure, the data recording system was incomplete.

With the permission of the judicial authorities, an on-site investigation of the device was conducted in the Islamic Republic of Iran. The device was then sent for data extraction, where certain parameters, including L/G Status, Time, and other flight conditions, were recovered and analyzed.

After analysis in France, the FDR data was read, and the results were reviewed. The CVR (Cockpit Voice Recorder) was also sent to France for analysis. A meeting was held with the presence of representatives of the mentioned parties to analyze and conclude the findings.

B: Specifications of the FDR device:

- Make: Allied Signal
- Type: 4120 SSFDR
- Type Number: 980-4120-GQUS
- Serial Number: 20298
- Recording Time: This type of FDR has a magnetic tape with a recording duration of 26.6 hours.

The initial FDR of this aircraft was manufactured and delivered at the time of its construction. The one provided to the Islamic Republic of Iran's airline was of the tape

type, while the SSFDR (Solid-State Flight Data Recorder) system developed by the engineering department of the company has a digital memory with an upgraded Data Frame Layout (decoding grid). However, it was not archived at the company.

The parameters of this device are in line with those of the Boeing 727 aircraft, and by using a similar system designed in 2011, it was recovered with credible accuracy. The final data decoding and processing were conducted in both Iran and France for further analysis.

The Flaps/Control Column functioned effectively. Additionally, this device did not record the time parameter, and to synchronize it with the timing of the air traffic control unit's communications, the HF Keying Signal parameter was used.

To analyze the precise sequence of events in the aircraft, cockpit voice recordings (CVR) were synchronized with the FDR technical data. This synchronization was measured using a comparison table that is included as an attachment along with FDR graphs.

According to international laws and ICAO (International Civil Aviation Organization) guidelines for reading flight data recorders, since the device was exposed to environmental factors such as rain and electricity, its memory (Memory) was separated and reconstructed in an Original device.

2-5-3: Analysis of the Flight Data Recorder Group

- The FDR and CVR devices functioned normally.
- Due to the possibility that one of the crew members' mobile phones was on, some recorded sounds in the CVR were partially distorted.

Above: The SSFDR opening

2.6 - Aircraft Technical Document Group Report

(Aircraft Technical Document Group)

2-6-1: General Information

- Aircraft Type: Boeing 727-286 (B727-286)
- Manufacturer: Boeing Co.
- Owner & Operator: Airline Company of the Islamic Republic of Iran
- AOC (Air Operator Certificate) Number & Expiry Date: FS-100 – 15 Nov. 2011
- Manufacture Date: June 1974
- Aircraft Serial Number: 20945
- Aircraft Registration Certificate & Issuance Date (Renewal): 5970-1 – 22 Nov. 2010 (1389/9/1 in the Persian calendar)
- Flightworthiness Certificate Number & Expiry Date: 5970-1 – 13 Dec. 2011
- Aircraft Radio Station License & Issuance Date: 72 – 19 Dec. 2006 (valid at the time of the incident)
- Radio License Supplement (RADIO LICENCE SUPPLEMENT) (New navigation and communication systems)
- License Number & Issuance Date: 72 – 19 Dec. 2006 (valid at the time of the incident)

Insurance company name, policy number, and validity date: Iran Insurance 89/12/29 - 4/0011/0367/90000: Date of issuance.

Total flight hours of the aircraft: 53,591.

Total cycles (landings and takeoffs) of the aircraft: 49,454.

With the necessary insurance coverage according to the regulations of the Islamic Republic of Iran, this aircraft has been covered by Iran Insurance Company from 1389/1/1 to 1389/12/29. This insurance policy covers all flight crew and passengers (including flight security personnel) up to the passenger liability coverage limit (150,000 Rials per passenger) and the flight crew accident coverage limit (540,000,000 S.D.R. per person during non-haram months and 400,000,000 Rials during haram months). Additionally, the third-party liability coverage limit is up to 700 million Euros. The insured value of the aircraft is two million Euros.

Aircraft technical checks are conducted based on the maintenance and repair instructions issued by the aircraft manufacturer, which have been approved by the Civil Aviation

Organization of Iran with the latest amendments as of October 1, 2009. With the authority granted by the Civil Aviation Organization of Iran, flight line checks are performed at authorized maintenance centers (A, B, D), weekly checks, and transit & daily checks. It should be noted that the "A" check is performed every 200 hours, the "B" check every 800 hours, and the "D" check every 2,190 days (6 years). The last heavy check of type "D" was performed from January 20, 2010, to December 6, 2010, in Tehran, with the aircraft's operational status at TSN: 53,449, CSN: 49,326. No unusual reports were recorded during this check. There are 2,142 calendar days remaining until the next "D" check. According to the regulations issued by the FAA under the title "Federal Register/ Vol. 75, No. 219/ Monday, November 15, 2010/Rules and Regulations," the overall service life of B727 aircraft (Design and Extended Service Goals) is currently limited to 60,000 flight cycles (FC). It should be noted that this limit can be increased under special conditions if additional inspections, such as corrosion control programs and supplemental structural inspections, are conducted and the aircraft's integrity is confirmed. The mentioned aircraft had 53,591 flight hours and 49,454 cycles (landings and takeoffs) until the day of the incident, with 10,546 cycles remaining until the incident since the aircraft's manufacture.

The remaining overall service life defined by the FAA was as follows. The aircraft's operational flight hours after major maintenance until the day of the incident were 142 hours and 128 cycles (landings and takeoffs).

The last "A" check performed on the aircraft was on 2010/12/06, with 64 hours remaining until the next "A" check.

The last "B" check performed on the aircraft was on 2010/12/06, with 664 hours remaining until the next "B" check.

The aircraft's periodic records and checks are summarized and maintained in the LOG. A general review of the technical documents and maintenance records of the mentioned aircraft indicates that flight line and periodic checks have been performed on the aircraft based on the manufacturer's maintenance instructions. Additionally, the latest maintenance checks performed on the aircraft are listed in the table below.

2.6.2 Landing Gear Information

1	19/01/2010	D5+B22+A02	TSN:53449 CSN:49326
2	12/06/2009	A01	TSN:53439 CSN:49318
3	27/09/2009	B21	TSN:53184 CSN:49100
4	15/03/2009	A03	TSN:52975 CSN:48925
5	13/02/2009	A02	TSN:52774 CSN:48758
6	17/01/2009	A01	TSN:52569 CSN:48572
7	20/11/2008	B20	TSN:52364 CSN: 48395
8	18/10/2008	A03	TSN:52154 CSN:48215
9	05/09/2008	A02	TSN:51957 CSN:48039
10	02/08/2008	A01	TSN:51749 CSN: 47863

Row	Date of completion	Check type	Performance level after O/H

Main Landing Gear Right Side (M.L.G. ASSY R/H)- Part No: 65-72761-36, Serial No: E061, installed on the aircraft on 2003/3/20. The operational hours since installation are 11,877 hours, 10,662 cycles, and 2,866 calendar days.

Main Landing Gear Left Side (M.L.G. ASSY L/H) - Part No: 65-72761-77, Serial No: DL239, installed on the aircraft on 2003/3/20. The operational hours since installation are 11,877 hours, 10,662 cycles, and 2,866 calendar days.

Nose Landing Gear (N.L.G. ASSY) - Part No: 65-72762-8, Serial No: 128, installed on the aircraft on 2007/10/8. The operational hours since installation are 41,461 hours, 41,074 cycles, and 1,204 calendar days. After major maintenance, the operational hours are 3,121 hours, 2,734 cycles, and 1,204 calendar days.

2.6.3: Engine & APU Details

This aircraft is equipped with 3 Pratt & Whitney JT8D-15 engines and one GTCP85-98CK APU. The technical specifications and operational details are as follows:

- Engine 1 - Serial No: 708343, installed on aircraft EP-IRP on 13.08.2010. The last major maintenance (first time) was performed on 16 FEB. 2006. The total flight hours since manufacture until the day of the incident are 58,247 hours (TSN: 58,247) and 47,834 cycles (CSN: 47,834). The operational hours after major maintenance until the incident are 1,031 hours and 913 cycles. The remaining cycles until the next major maintenance are 3,214 cycles (for LPTD2). The operational hours since installation on this aircraft until the incident are 142 hours and 128 cycles.

The history of this engine shows that it was removed and repaired on 2007/08/24 due to "High oil consumption" with operational hours of 58,104 hours (TSN: 58,104) and 47,706 cycles (CSN: 47,706) on aircraft EP-IRR.

- Engine 2 - Serial No: 687541, manufactured on 19.03.1975. The last major maintenance (fifth time) was performed on 20 FEB. 2009. After this maintenance, it was installed on aircraft EP-IRP on 14.08.2010.
- This engine has a total of 39,483 flight hours (TSN: 39,483) and 37,553 cycles (CSN: 37,553) from the time of manufacture until the day of the incident. The operational hours after major maintenance and since installation on this aircraft until the incident are 142 hours and 128 cycles. The remaining cycles until the next major maintenance are 1,868 cycles (for LPCD1).
-
- The history of this engine shows that it was removed on 2007/08/19 for major maintenance with operational hours of 39,340 hours (TSN: 39,340) and 37,425 cycles (CSN: 37,425) on aircraft EP-IRP.
-
- Engine 3 - Serial No: 687391, installed on aircraft EP-IRP on 17.08.2010. The last major maintenance (first time) was performed on 01 DEC. 2006.
-
- This engine has a total of 67,897 flight hours (TSN: 67,897) and 47,126 cycles (CSN: 47,126) from the time of manufacture until the day of the incident. The operational

hours after major maintenance until the incident are 155 hours and 137 cycles. The remaining cycles until the next major maintenance are 7,244 cycles (for HPTD1). The operational hours since installation on this aircraft until the incident are 143 hours and 128 cycles.

-
- The history of this engine shows that it was removed on 2010/05/05 with operational hours of 67,742 hours (TSN: 67,742) and 46,989 cycles (CSN: 46,989) on aircraft EP-IRR and installed on aircraft EP-IRP on 2010/08/17.
-
- APU - Serial No: P.15056, manufactured on 11.03.1968 and installed on aircraft EP-IRP on 03.10.2010. This APU has a total of 42,996 flight hours (F/H) and 39,742 starts from the time of manufacture until the day of the incident. The third major maintenance was performed on this APU in OCT. 1996, and the operational hours after major maintenance until the incident are 143 hours and 128 cycles.
-
-
-
- **2.6.4: Navigation and Communication Systems Information**
-
- In addition to the usual communication and navigation systems and equipment, this aircraft is equipped with advanced avionics systems to meet flight capability requirements, including ACAS II (ver. 7), ATC-Mode S, and B-RNAV.

The aircraft is also equipped with VHF COM and VHF with FM IMMUNITY, and necessary modifications have been made to upgrade these two NAV systems.

The available technical documents indicate that all necessary checks and modifications for this aircraft have been continuously and regularly performed by authorized personnel, and the aircraft has been approved and cleared for all flights.

2.7: Structure Group Report

The expert assessments of the latest condition of the Boeing 727-200 aircraft, registered as EP-IRP with serial number 20945, are as follows:

- The Boeing 727 aircraft, registered as EP-IRP, was manufactured in January 1974 and joined the Iran Air fleet.
- It has been in service with the aforementioned company until the date of the incident.
- Periodic and major maintenance of this aircraft has been carried out at the technical and maintenance facilities of Iran Air. Engine and component inspections have been conducted within the technical and maintenance authorities in Tehran, and tasks beyond the company's capabilities have been outsourced to contracted maintenance resources inside and outside the country.

Main Characteristics of the Boeing 727:

This medium-sized aircraft is equipped with three Pratt & Whitney JT8D engines, and all its components are American. The maximum passenger capacity is 189 passengers with 2 flight engineers, and it has been active in the global aviation fleet since 1963.

1: Aircraft Historical Records

According to the latest information, the aircraft has accumulated 53,591 flight hours and 49,454 cycles since its inception. (Note: Detailed and separate information on the engines is provided by the engine working group.)

The aircraft underwent major maintenance in February 2006 and, based on the latest maintenance schedule, was again subjected to major maintenance on 2010/12/06, with a 6-year interval. Recently, it has been undergoing basic maintenance standards.
The next heavy maintenance was scheduled for December 2016.

Based on the latest technical clearance, the major maintenance check D-05 was performed from 2010/01/09 to 2010/12/06 in Tehran. Due to the simultaneous periodic checks, the "A" check was performed every 200 flight hours, and the "B" check was performed every 800 flight hours on 2010/12/06. As of 2010/01/09, there were 59 flight hours remaining until the next "A" check and 65 flight hours remaining until the next "B" check.

It is worth noting that during the major maintenance, a total of 161 technical orders were executed on the aircraft, including 2 specialized WCCR instructions, 2 engineering instructions, and 2 ad-hoc inspection instructions. Following flight tests, the aircraft rejoined the Iran Air fleet and officially received its airworthiness certificate from the Civil Aviation Organization on 2010/12/04. It resumed passenger transport operations from 2010/12/17 until the date of the incident on 2011/01/09, accumulating a total of 53,591 flight hours and 49,454 cycles during its operational history.

Since the aircraft's major maintenance, which is considered the most significant maintenance, the technical performance review is based on the period starting from 2010/01/09. The aircraft had no flights from June 2009 until the start of its major maintenance on 2010/01/09, which was completed on 2010/12/06. Flight tests began on 2010/12/07 with the approval of the Civil Aviation Organization, and the first passenger flight took place on 2010/12/17. Until the date of the incident, the aircraft had completed 21 days of flight operations.

No structural issues were reported in the aircraft's structure according to the flight report forms, and there were no reports of structural problems affecting the aircraft's flights up to the date of the incident.

The aircraft underwent daily inspections and was cleared for flight operations within the next 24 hours on 2011/01/08. On 2011/01/09, it underwent a Transit Check in preparation for the flight and was cleared for operation. On the day of the incident, there were no pending structural issues.

It is important to note that any issues related to the systems, components, engines, landing gear, and non-structural parts are not discussed in this section of the report and will be examined in detail by the relevant group.

2- Technical Instructions:

Given that the aircraft had undergone major maintenance more than a month prior and was subsequently approved by the country's aviation organization inspectors, its airworthiness certificate was renewed for one year from 13/12/2017. From the date of its last recorded flight until the incident, no technical defects were reported.

A review of all operational procedures was conducted, and after a Type "A" check, 59 flight hours remained.

It is worth mentioning that during the major maintenance, the aircraft's structural components were thoroughly inspected for any signs of corrosion, warping, discoloration, cracks, or other defects. The inspection confirmed the structure's integrity. Moreover, a certificate of continued airworthiness was issued, and no structural damage was reported during subsequent inspections.

Conclusion:

The documentation was examined, including flight discrepancy reports, maintenance logs, component lists, and available technical reports. Based on the analysis, a precise conclusion required further review of the black box recordings, all radio communications, and relevant hidden factors.

Only after collecting all necessary information, including radio transmissions and FDR (Flight Data Recorder) graphs, can it be determined whether the aircraft was in a normal operational state or whether technical issues had been reported in prior communications before the incident.

2.8 System Group Report (System Group):

For analyzing the performance of aircraft systems, specifically the B727 with EP-IRP registration, it is necessary to familiarize ourselves with some of the aircraft's systems:

2.8.1 Engine Bleed Systems:

- Engine numbers 2 and 3.

For the aircraft's air conditioning system to function normally, bleed air from the 8th and 13th stages is used. This air is regulated by a Modulating Shut-off Valve (M.S.V) and then passes through the Air Cleaner before entering the A.C. (air conditioning) section. After that, the bleed air moves to the associated Air Conditioning Pack.

In steady conditions, when the throttle is placed in the advance position and RPM increases, the air from the 8th Stage receives enough pressure, and the Modulating Shut-off Valve (M.S.V) closes, directing only the air into the Pack.

Engine No. 2:

- The 6th, 8th, and 13th Stages of the engine supply air for the anti-ice system of engine No. 2 (S duct, Nose cowl).
- The air from the 8th Stage is directed through an Isolation Valve (V) located at the rear. If the Air Conditioning system requires assistance, this air can be used through the switch panel on the flight deck.

- The air from this Stage is sent to the Isolation Valve (V) for Pack No. 1 or 2.

Anti-ice for Engines 1, 3, and Wing:

- When activating the Anti-ice system for engines 1 and 3, air is taken from the 8th Stage and directed to Inlet Guide Vanes to hit the engines.
- Simultaneously, air from the 13th Stage passes through a valve called Vain Cowl Thermal Anti-ice, which modulates the temperature. This heated air is then sent to the Nose Cowl, preventing ice buildup.
- When activating the Anti-ice system for the wing, air is drawn from the 13th Stage and mixed with the 6th Stage to create warm air.
- This warm air passes through the left cargo door, enters the wing, and is then directed outboard.
- If the wing anti-ice system is activated, part of the bleed air from engines 1 and 3 exits the system.
- When the throttle is in the advance position and anti-ice is activated, the system operates efficiently.
- However, if throttle settings are not increased, the EPR (Engine Pressure Ratio) should not be below 1.70.
- Additionally, if the system operates for more than 55 minutes, it may cause excessive heat buildup.
- The aircraft's anti-ice system is only dedicated to the two wings and engines and does not include control surfaces or other parts of the aircraft.

Ignition System in the Engines:

- The Ignition System of this aircraft (P&W JT8D-15 engines) is powered by the Hot Butt Bus during engine start.
- If the Start Ignition Circuit Breaker (28 VDC) is active, the system will engage.
- Engine startup is dependent on the Start Lever being in the open position and the ignition switch being turned on.

In GND/Flight Switch mode, even if Bleed Air is not available, the system operates, producing the ignition spark through two Igniter Plugs (CAN NO.4 & 7), which are commonly used in continuous ignition mode.

Once the engine start switch ENG Start is set to Off, and in the event of flight in special conditions (such as Bad Weather or Ice Conditions), the Continuous Ignition switch is turned on. This prevents the engine from shutting down unexpectedly.

- By turning on this switch, 15VAC electricity is supplied through the Continuous Ignition Circuit Breaker, activating the Continuous Ignition circuit via CAN NO.7.
- This ensures continuous sparking to prevent the engine from shutting down due to water or air entering.

The Continuous Ignition system requires AC power, which is provided by the AC BUS. Since this power is essential for all generators, it remains active even if one generator fails.

It is important to note that the Ignition System in this aircraft operates independently from the Start Ignition system. This means the Continuous Ignition system functions separately from Continuous Start.

Distance Measuring Equipment (DME)

The main function of this system (SYS) is to display the aircraft's distance from a ground station, in VOR/DME format, using Slant Range, depending on aircraft altitude.

This aircraft is equipped with two DME systems, operating in the frequency range of 1025-1150 MHz.

- The transmitter/receiver unit is installed in the E&E BAY section of the aircraft.
- The system includes Collins-manufactured models 860E-2, with an output power of 700 watts.

Components of the System:

1. VHF NAV DME Control Panel
2. Two numerical indicators per system, displayed on the HSI (DME Indicator)
3. DME Interrogator
4. DME Antenna

The main power supply for the system is 115V AC, which is converted from DC to AC inside the Interrogator unit.

- When the system operates normally, the DME IND shows the (-) sign.
- This indicates that the system is functioning correctly.

If the DME is damaged or in STBY or Search Mode, it will go blank and not show anything (Warning Flag)
The electricity distribution network of this system is as follows:
SYS 1: 115 VAC ESS Radio Bus & 28 VDC ESS Radio Bus
SYS 2: 115VAC Radio Bus #2 & 28 VDC Radio Bus # 2
: Radio Altimeter •
This system measures and displays the actual height of the aircraft from the ground during the approach
(up to 2500 ft)
Two completely separate Radio Alt systems have been installed on this plane, the transceiver unit of each
system is of the ALA51A type and manufactured by the Honeywell factory, and its output power is 300 milliwatts.
The system works at a frequency of 4.36 GHZ, which by sending a signal by one antenna and receiving a return signal
by another antenna and comparing the sent and received signals in the transceiver unit (RX/TX) and converting
it into a DC voltage, the height value is announced in the corresponding indicator and also sent to other aircraft
systems such as TCAS ADI and GPWS.
By using the knob on IND, you can set the triangular indicator around the
IND screen and set the DH height. If there is a Power Failure, a Warning Flag will appear on the IND.
The electricity distribution network of this system is as follows:
Radio Alt #1: 115 VAC ESS Radio Bus
Radio Alt # 2: 115 VAC Radio Bus
:(Automatic Direction Finder)ADF

The ADF system in this aircraft is of type 7-51Y manufactured by Collins factory and works in the
frequency band of 90-1750 KHZ and has the ability to show the direction of the station relative to the aircraft on the RMI
indicator and also create the desired station code through the aircraft's Aural System (station identification code).
ADF components There are two ADF systems in this plane, which include the following accessories:

Sense ANT - Loop ANT - Receiver - ADF/RMI - Control Panel - Sense ANT Coupler - QEC

This indicator can provide information to the co-pilot in such a way that:

- Magnetic heading data is read from the Compass Card,
- Bearing information is displayed via the pointer needles.

A flag labeled “Off” appears on the indicator when the Compass Card heading information is invalid.

- Additionally, if there is any power failure in the RMI indicator, this Off Flag will also appear.

The ADF1 & ADF2 systems are independent of each other:

- ADF1 is powered by 115VAC, 28VDC STBY BUS,
- ADF2 is powered by 115VAC, 28VDC Radio Bus #2.

It is important to note that each system receives its own power supply separately.

- If ADF is set to ANT mode, the corresponding needle will be positioned at 9 o’clock (horizontal position), which is known as the Stowed Position.
- If the ADF does not receive a signal, the needle will remain in the same position.

(EGPWS) Enhanced Ground Proximity Warning System

This system is designed to prevent collisions with mountains, obstacles, and tall buildings near the airport. Its installation is mandatory on aircraft.

In this aircraft, the EGPWS system is of type MK-VII, manufactured by Honeywell.

- The system includes a central computer that receives input from various sensors and aircraft systems.
- After processing the data, it provides audible, visual, and written warnings when necessary.

The system consists of seven modes, described as follows:

Mode 1: Excessive Descent Rate

- If the aircraft loses altitude too rapidly and approaches the ground steeply, the system triggers a “Sink Rate” warning.

Mode 2: Excessive Terrain Closure Rate

- If the aircraft approaches a mountain at a very steep angle, the system issues a “Terrain, PULL UP!” warning.

Mode 3: Altitude Loss After Takeoff

- If the aircraft loses altitude during takeoff or go-around (between AGL: 50-700 ft), the system issues a “Don’t Sink, Don’t Sink!” warning.

Mode 4: Unsafe Terrain Clearance

- If the aircraft is in landing configuration and:
- The landing gear is not extended below AGL: 500 ft,
- Or the flaps are not set to landing position below AGL: 200 ft,
- Or during descent at a certain altitude of AGL 200ft, to 500 ft, if the descent is too extreme, all these will cause a "Sink Rate!" warning as well as the following:

- “TOO LOW - GEAR”
    - “TOO LOW - FLAPS”
    - “TOO LOW - TERRAIN”

Mode 5: Excessive Deviation Below Glide Slope

- If the aircraft has significant deviation from the glide slope (with altitude between AGL: 50 - 1000 ft, landing gear down, and ILS frequency set), the system issues both visual and audible warnings:
- “GLIDE SLOPE”

Mode 6: Advisory Callouts

- When the aircraft descends to the pre-selected decision height (DH) during approach, the system issues the warning:
- “Minimums”
- If the aircraft’s bank angle exceeds the preset limit calculated by the EGPWS computer, the system issues the audio warning:
- “Bank Angle”

Mode 7: Wind Shear

- The EGPWS computer detects wind shear based on:
- Airspeed
- Radio altitude
- Static pressure
- Angle of attack
- Outside temperature
- Aircraft acceleration
- If wind shear is detected, the system issues an audio warning:
- “Wind Shear”

According to recorded warnings in the aircraft’s CVR (Cockpit Voice Recorder), the system properly functioned until the last moment, issuing the necessary alerts before the accident occurred.

Weather Radar

The primary function of this radar is to detect weather conditions along the aircraft’s flight path based on the moisture content within clouds and the density of this moisture. It helps the pilot avoid passing through dangerous, high-electrical-charge storm clouds. Additionally, this radar has a MAP mode, allowing it to display terrain features such as mountains, rivers, and coastlines.

This aircraft is equipped with one Weather Radar system, operating in the 9375 MHz frequency band, with an output power of 65 kW. The system is of type PDR-F1, manufactured by Honeywell.

The radar system operates on:

- 115 VAC, 400 Hz
- 35 VDC
- 10A current for 28 VDC

The radar transmits signals, which, upon hitting a target, are displayed on the screen in four different colors, as follows:

1. No return – No significant weather or obstacles.
2. Minimum return – Safe areas with no significant hazards.
3. Moderate return – Areas requiring caution while passing.
4. Maximum return – Areas that should be avoided as much as possible.

This system is powered through the 115 VAC Radio Bus.

VOR / ILS System

This system provides information about the aircraft's position, the degree of deviation from the selected course, and approach and navigation data from the ground station.

This aircraft is equipped with two independent VOR/ILS systems, operating within the 108–118 MHz frequency band and manufactured by Collins.

Additionally, the system includes a switch that allows each system to independently supply data to both the pilot's and co-pilot's indicators.

Depending on its usage, VOR/ILS system data is displayed on the HSI (Horizontal Situation Indicator), ADI (Attitude Director Indicator), and RMI (Radio Magnetic Indicator).

The system's power distribution network is as follows:

VOR / ILS #1: 28VDC ST-BY BUS, 115 VAC ESS BUS
VOR / ILS #2: 28 VDC Radio Bus2, 115 VAC Radio Buses 2

Engine Indications

1. EPR (Engine Pressure Ratio)

This aircraft includes the following components for each engine:

- PT2 or Inlet Pressure Sensing Probe: One unit
- PT7 or Exhaust Pressure Sensing Probe: Six units
- EPR Indicator: One unit
- EPR Transmitter: One unit

The ratio of inlet air pressure to exhaust air pressure is one of the important parameters for assessing engine power. This is performed by the PT2 EPR system located in the Nose Dome. The PT7 Anti-Ice system protects the engine probes from icing and consists of six probes. The output from these probes is combined and sent to the EPR Transmitter.

The pressure obtained by PT2 is also sent to the EPR Transmitter, which converts the ratio of PT7 to PT2 into a signal and sends it to the IND (Indicator).

2. Tachometer (N1 & N2)

To indicate engine performance, one transmitter is used for N1 (Low-Pressure Compressor) and another for N2 (High-Pressure Compressor). The N1 is located at the front of the Accessory Drive, while N2 is at the rear. The IND converts the mechanical rotation into an electrical signal to display the RPM of the compressors. The N1 and N2 indicators are marked in percentages from 0 to 100, with color bands defining normal, caution, and limit ranges.

3. Vibration Pick Up

To provide information about engine health, this indicator is installed on the flight engineer's panel. The system includes two units: a Vibration Pick Up and a Monitor Unit, along with an IND.
Vibration Pick Up
The Vibration Pick Up is responsible for converting the engine's vibrational energy into an electrical signal proportional to the amplitude of the vibration and transmitting it to the Monitor Unit. The Monitor Unit amplifies this signal and sends it to the relevant IND (Indicator). The Vibration Pick Up units are positioned at two locations: one at the front of the engine at the 11 o'clock position to indicate compressor vibration, and the other at the rear of the engine at the 6 o'clock position to indicate turbine vibration.

4. EGT (Exhaust Gas Temperature)
The EGT is one of the important engine indicators that can show the mechanical condition of the engine, the turbine's condition, and the overall engine status. This system consists of 8 thermocouples arranged in a circular pattern and installed in the P2 section of the engine's exhaust. The indicator for this system is located on the panel and operates on the 115VAC-STBY BUS. The thermocouples are connected in parallel to measure the average temperature. The EGT IND is calibrated from 0 to 850 degrees Celsius, with color bands indicating normal and caution ranges. The range between 500 to 700 degrees is more precisely calibrated to allow for accurate temperature readings. The temperature difference between the Hot Junction and Cold Junction of the thermocouples generates an electrical signal proportional to the temperature. This signal is amplified and sent to the IND.

Electrical Power (Aircraft Power Supply System)
The aircraft's power distribution network includes three systems for generating and distributing three-phase electrical power with a voltage of 115VAC and a frequency of 400 Hz. Additionally, single-phase transformers are used to reduce this power and convert it to 28VAC. Four TRUs (Transformer Rectifier Units) are used to convert the three-phase power to 28VDC. In emergencies, a battery is used to supply power to critical systems.

The AC (Alternating Current) power generation system includes three brushless, self-excited generators with a capacity of 40 KVA or 55 KVA and a voltage of 115–208VAC. These generators can operate independently or in parallel during flight to provide the necessary power for the aircraft. Additionally, another generator is used with the same specifications, powered by the APU (Auxiliary Power Unit), is located in the space between the two Main Landing Gear and is used to provide power on the ground.

Additionally, on the right side of the aircraft's nose, a connection point for External Power is installed.

The APU generator cannot operate in parallel with the main generators or External Power.

To maintain a constant generator speed (frequency of 400 Hz) at any desired engine speed, a hydromechanical, electrically controlled CSD (Constant Speed Drive) is used between the engine gearbox and the generator shaft. This component is called the CSD. The APU generator does not have a CSD.

In this aircraft, there are three main buses named AC BUS 1, AC BUS 2, and AC BUS 3, each independently powered by its respective generator. The voltage and frequency of each bus are controlled by the Voltage Regulator and Load Controller. The generators can be connected in parallel through the Synchrony Bus and supplied via the BTB (Bus Tie Breaker). It is important to note that no consumer is directly connected to the synchrony bus. Therefore, if a generator is disconnected, the corresponding bus is supplied by another generator through the synchrony bus and the BTB.

Both External Power and the APU can only be connected to the synchrony bus independently and not in parallel with another power source.

For controlling the circuit from power generation to the load connection, a Fault Annunciation Panel is designed. If a voltage difference exceeding 30-40 amps occurs, the system activates and indicates the fault through a voltage drop across a resistor and rectifier. This causes the GCR (Generator Control Relay) to trip and the GCB (Generator Circuit Breaker) to open. As long as the fault persists, none of the generators can be reconnected to the circuit. Additionally, a light on the Annunciation Panel will illuminate.

To supply 28VDC direct current power from 115VAC alternating current, the following TRUs (Transformer Rectifier Units) are used:

- TRU 1: Supplied by AC BUS 1.
- TRU 2: Supplied by AC BUS 2.
- ESS TRU: Supplied by the ESS AC BUS.

EXT TRU: Supplied by the EXT AC BUS.

The battery can also be used as a power source. An Inverter is used to convert the battery's DC power to 115VAC 400Hz when needed.

In this aircraft, there are two types of DC BUS:

1. Type 1: These buses can be supplied by both the battery and the TRU (Transformer Rectifier Unit). Therefore, these buses always have power and can supply critical systems in emergencies. These buses include:
   - Hot Butt Bus
   - Hot Butt Transfer Bus
   - Butt Bus
   - Aux Hot Butt Bus
   - Butt Transfer Bus
   - ST BY DC Bus
2. Type 2: These buses are only supplied by the TRU and include:
   - No1 DC Bus

- No2 DC Bus
- Ess DC Bus
- EXT DC Bus

ESS AC BUS
This bus can be supplied by all available AC sources (GEN1, GEN2, GEN3, APU, EXT, ST-BY). On the flight engineer's panel, there is a six-position switch that allows the flight engineer to select which of the six sources will supply the ESS BUS. During normal flight operations, the ESS BUS is typically supplied by GEN3. If an issue arises and GEN3 is disconnected, the flight engineer can rotate the switch to select another source, such as GEN1, to supply the ESS BUS. It is important to note that when switching sources, consumers connected to the ESS BUS may momentarily lose power and then be re-energized. If the ESS BUS loses power, a red light on the flight engineer's panel and a blinking light on the Instrument Panel will illuminate and remain on until the issue is resolved and a new source is selected.

ST-BY Power
This power source is critical for safe flight continuation in the event of a failure of the ESS AC systems. In such cases, the output of the Inverter is connected to the ST-BY AC BUS, and its input is supplied by the DC Batt Bus. This requires the Ess Selector Switch to be set to ST-BY. If the aircraft is in flight and the electrical system is cut off, and the ESS BUS has no power, a signal is sent to activate the ST-BY Power.

ESS Power Failure: The L/G Accessory Unit model automatically activates the ST-BY Power without the need to manually select the Ess Selector Switch. The ESS Bus is supplied through the ST-BY AC when the Selector Switch is in the ST-BY position.

The investigations and analyses conducted on the aircraft's power supply system indicate that the communication and navigation systems described above were active and functioning normally until the final moments before the incident.

2.8.2: Examination of the Anti-Ice System for Both Wings and All Three Engines

According to the CVR (Cockpit Voice Recorder) at 15:45:20, the request to activate the Anti-Ice system was made. Two seconds later, the flight engineer confirmed that the Anti-Ice system was on.

Based on the remaining evidence in the cockpit after the incident, the Anti-Ice switches for all engines were in the Open position, and the corresponding valves on the engines were also in the Open position.

- At the moment the flight engineer activated the Anti-Ice system, a "beep" sound was heard on the CVR. This sound was likely related to the opening of the valves and the final check to confirm whether the valves were open or closed.
- According to the images of the PNL (Panel) after the incident, the Anti-Ice system for Engine No. 1 was in the Open position, while Engine No. 3 was in the Closed position. It is possible that the position of the PNL changed after the incident due to an impact or movement during the event.
- After opening each valve, the flight engineer checked the Light indicators to confirm the open or closed status of the valves. The CVR recordings confirm that the system was functioning correctly, and there was no mention of any issues with the Anti-Ice system.

As we know, the Wing Anti-Ice system is supplied by air from Stage 6 and Stage 13. These two air streams are mixed together, pass through the high-pressure valve and the thermal Anti-Ice valve, and then enter the Anti-Ice system on the left side of the aircraft.

Therefore, even if the flight engineer had not activated the Anti-Ice system for Engine No. 1, Engine No. 3 would have performed this function.

“When should the pilot turn on the Anti-ice system?
It should be noted that this aircraft does not have an ice detector, and when the pilot observes that ice is forming on the aircraft’s wings or around the windows, the Anti-ice system is usually turned on. According to the flight manual, wherever it is specified, this information can be found on Section 3, Page 11A.”

2. At what point during this flight did the pilot turn on the Anti-ice system? According to the communications at 15:25:27 at an altitude of 13,350 feet, the pilot gave the order to turn on the Anti-ice system. According to the flight manual, when the aircraft is flying in snowy and icy conditions, the following is stated on Page 11A, Section 3:

“When ice accumulation on the cockpit window FRAMS, windshield center post, or on the windshield wiper arm may be used as an indication of structural icing conditions and the need to turn on the wing anti-ice system.”

It should be noted that according to the flight manual, the N1 must not be less than a certain percentage in anti-ice mode, which the flight engineer was also aware of. At 15:25:31, the flight engineer mentions, “Is N1 = 55?” and the pilot replies, “Yes, we do have it.” The flight engineer also checks the temperature of the anti-ice system and says, “It’s very warm,” which is recorded in the CVR at 15:35:37.

Note: The flight manual emphasizes before turning on the Wing Anti-ice or Anti-ice system that “Turn engine ignition on prior to activating anti-ice,” meaning the engine ignition system must be on before activating the anti-ice system. However, this is not heard in the CVR.

(Page 11A, airplane flight manual, section 3)

2.8.3 Air Conditioning:
Based on the communications, no issues were mentioned regarding the Air Conditioning system. At 15:37:07, the pilot requests, “Make it warmer,” and the flight engineer performs this action. If there had been an issue with the Air Conditioning system, it is highly likely that the flight engineer would have mentioned it, and it would have been recorded in the conversations.

2.8.4 VHF Communication: System Performance Review
The cockpit communications with the air traffic control tower, recorded in the CVR until the last moment of the flight, indicate that the system had the necessary power and was functioning normally.

2.8.5 Electric System Performance Review

Some survivors of the incident have stated that, in the final moments of the flight, the aircraft's power (passenger cabin) was intermittently lost and restored. Could this be accurate, and does it indicate a fault in the aircraft?

As explained in the electrical systems section, when the power source supplying the ESS BUS (generator 3) was lost, the corresponding failure light illuminated, and the flight engineer immediately switched the ESS Power switch to select a new power source (generator 1 or 2), replacing the lost power source, which restored power to the ESS BUS. Therefore, at the moment the switch was turned to select the new power source, all consumers powered by the ESS BUS (such as part of the passenger cabin lighting system) were briefly turned off and then powered back on once the new source was selected. It seems that with the loss of engine 3, its generator was taken offline, and the passenger cabin power was briefly interrupted. This was immediately restored when the flight engineer selected generator 2, and power was supplied to the ESS BUS, re-establishing power to the cabin. When engine 1 was lost, the cabin power was interrupted again, but once the new power source was selected, power was restored to the cabin.

It should be noted that part of the cabin lighting system is powered by the ESS BUS, and the explanation for the on-and-off behavior of this part has already been provided. Another part of the cabin lighting system is powered by the XFR Bus, which in flight gets its power from generator 3. Therefore, with the loss of generator 3, the XFR Bus lost power, and consequently, the other part of the cabin lighting system that was powered by this bus also turned off.

Thus, the intermittent loss and restoration of power to the passenger cabin was a natural occurrence following the engine failures.

2.8.6 Navigation System Performance Review

Based on the CVR content of the aircraft, since the flight crew did not mention any failure of the aircraft's navigation systems, and the pilot and co-pilot used various navigation systems as needed throughout the flight, a clear example of this is setting the altitude, radial, and DME at the last moments of the flight.

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Therefore, it can be concluded that the navigation systems had the necessary power and were performing their functions correctly.

It should be noted that with the presence of various backup power sources to supply the navigation systems, even if the aircraft's power was lost, the navigation systems could continue to operate by drawing power from the battery. Consequently, the vital navigation systems were available to the pilot and co-pilot at the last moments of the flight for optimal use, and there were no recorded issues with the navigation systems.

2.8.7 EPWS System Performance Review

Based on the warnings recorded in the CVR (modes 1 and 3), this system performed its duties correctly until the last moment and issued the necessary warnings before the accident occurred.

2.8.8 Engine Ignition System Performance Review

On the CB panels found after the accident among the wreckage of the aircraft, several circuit breakers (CBs) of the aircraft's vital systems were in the open (out) position. This

indicates that some of the CBs may have been in the open position due to a short circuit in the system caused by the aircraft's impact with the ground and the connection of wires in the circuit. Regarding the CBs that were in the closed (in) position, it can be said that the systems associated with these CBs were either off or active at the time of the accident, and no short circuit occurred in these systems.

Given the conditions of the flight, which occurred in cold and icy weather, the pilot should have set the Continuous Ignition switch to the ON position according to the procedure. However, the switch found in the wreckage of the aircraft was in the OFF position (based on the available evidence). It seems that this system was not active, but it is possible that the switch was knocked to the OFF position upon impact with the ground. Therefore, a definitive statement about the status of this system is not possible at this moment.

2-8-9: Investigation of the Cause of Engine Power Loss Assuming the Presence of EP-IRP (Engine Pressure Ratio)

1. Operational Issues Affecting Engine Power Loss

Based on the analysis of CVR (Cockpit Voice Recorder) and FDR (Flight Data Recorder) data, the following operational issues may have contributed to the engine power loss:

- There is no mention in the CVR of activating the Anti-Ice system or Continuous Ignition during adverse weather conditions. Additionally, the Operation Manual states:
- "Do not make rapid thrust changes in extremely heavy precipitation (rain, hail) unless excessive airspeed variations occur. If thrust changes are necessary, move the thrust levers very slowly."

Despite this manual's emphasis, at 16:00:50 and at an altitude of 8715 feet, a rapid acceleration was performed within two seconds, resulting in the following EPR (Engine Pressure Ratio) changes:

- Engine No. 1: EPR dropped from 1.43 to 1.09.
- Engine No. 2: EPR dropped from 2.07 to 1.36.
- Engine No. 3: EPR dropped from 1.73 to 1.21.

The Operation Manual also states:

- "Avoid rapid thrust lever movements to prevent engine surge or flameout."

The above reasons suggest the possibility of operational issues leading to engine power loss and potential engine shutdown.

2. Dynamic Airflow Issues Affecting Engine Power

It is entirely clear that if the airflow entering the engine is not direct, it can cause a relative reduction in engine power. According to the FDR, in the final moments at 16:00:54, the aircraft had a roll angle of -39 degrees. At this point, Engine No. 3 received less airflow compared to Engine No. 1 because Engine No. 3 was at a higher angle of attack and thus exposed to a greater volume of hail. This large volume of hail caused Engine No. 3 to shut down, while Engine No. 1 experienced a delayed shutdown a few moments later.

The S-duct shape of the engine's intake caused the rain and hail to rotate inside the engine and bypass it, exiting through the bypass duct. This is why Engine No. 2 did not shut down

Therefore, it can be concluded that the way air and hail enter the engine has a significant impact on the engines, and aerodynamics greatly affect engine power.

3. Engine Icing and Its Impact on Power Loss

There is a possibility of ice formation at the engine inlet. If ice forms at the engine inlet, the incoming airflow can become turbulent, leading to a potential stall condition. Additionally, there is a possibility that the ice formed at the inlet could break off and enter the engine. However, inside the engine, the compressor compresses the air, raising the temperature in the compressor section, which completely eliminates the possibility of icing inside the engine.

To prevent engine icing, the JT8D engine is equipped with an anti-ice system for the inlet and nose cowl, which is supplied by air from Stage 8 and Stage 13 of the engine. According to the CVR (Cockpit Voice Recorder), the pilot activated the anti-ice system during the descent approach, and no warnings were observed in the CVR indicating a malfunction in the engine anti-ice system. It is worth noting that in rare cases, if the aircraft flies for an extended period in snowy and hail conditions, there is a possibility of thin ice layers forming on the fan blades. In such cases, since the fan blades are rotating components, their balancing could be disrupted, leading to increased vibration. However, no such vibration issues were reported for the EP-IRP aircraft.

4. The Impact of Wing Icing on Engine Power Loss

By analyzing the CVR and FDR (Flight Data Recorder) conversations, it is observed that at 15:57:47, the flight engineer, despite the anti-ice system being on, mentioned that ice might have formed on the wings due to the weather conditions. Approximately 10 seconds later, the pilot responded that, given the speed of 170-180 knots, the wings should not be icing.

The anti-ice system heats only the leading edge of the wings, and the rest of the wing does not require heating. If ice forms on the leading edge, it can disrupt the airflow over the wing, causing turbulence across the entire wing surface and significantly reducing the performance of the wing.

No issues with the anti-ice system's performance were mentioned in the conversations until the final moments, and the wing performance was reported to be good. However, there is a possibility that, since the aircraft flew at low altitudes for an extended period in snow and rain, thin layers of snow or ice may have formed on the wings. If ice or snow accumulated on the internal part of the wing, suddenly break off and enter the engine intake, it could cause vibration and potentially lead to a momentary loss of engine power. However, this incident was not reported.

Given the prolonged flight in snowy and icy conditions, and the suboptimal power settings selected for the engines, there is a possibility that the anti-ice system's air temperature was insufficient to adequately heat the leading edge of the wing. This could gradually lead to ice formation on the wing, increasing the stall speed and causing the aircraft to experience a stick shaker activation for the second time.

5. Fuel and Its Impact on Engine Power Loss (EPR)

Based on the above, three critical factors are necessary to maintain engine power: fuel, air, and ignition. Fuel is one of the most important components. In the Boeing 727, fuel normally flows from the fuel tanks to the respective engines. Each fuel tank supplies its corresponding engine under normal conditions. The fuel in commercial aircraft is of type A, which does not freeze easily in cold temperatures. However, water droplets that may form in the fuel and are sent to the engine by the pump could cause icing in the fuel system.

In JT8D engines, the fuel passes through the main fuel first stage, then through the air/fuel heat exchanger, and enters the filter. After passing through the filter, it goes to the main fuel pump second stage, then to the fuel control unit, and finally to the fuel nozzles via the fuel cooler. If water droplets are present in the system, ice could form in the filter, potentially blocking the fuel flow. To prevent this, a bypass valve is installed in the system. If the filter becomes clogged, a Δp=8-10 psi pressure switch in the cockpit sends a signal to alert the crew.

In such cases, the flight engineer turns on the fuel heat switch, which remains on until the ice melts and the system returns to normal. After the ice has melted, the switch is turned off.

For the EP-IRP aircraft's engines, it appears that the fuel system was functioning properly and did not cause any issues for the engines. However, if the fuel heat system were to remain on continuously, it could cause a series of problems, such as an increase in engine oil temperature.

6. Mechanical Issues and Their Impact on Engine Power Loss (EPR)

In the Boeing 727, the JT8D engines are controlled entirely mechanically from the cockpit. Any malfunction in this system can directly affect engine performance. In the fuel delivery system of these engines, all controls pass through the fuel control unit, which operates either mechanically or hydraulically. Any failure within this unit can lead to a loss of engine power. However, for the EP-IRP aircraft, it seems unlikely that both engines would simultaneously experience mechanical issues, as this would be highly improbable. Additionally, there is no mention of mechanical faults or performance issues in the CVR (Cockpit Voice Recorder) conversations.

2-8-10: Examination of the First Stick Shaker Activation

Assumption 1: Effective Anti-Ice System On, N1 > 55%

At an altitude of 7000 feet and a speed of approximately 190 knots, the pilot needed to maintain altitude and exit the descent. To prevent a decrease in speed, the engine parameters should have been increased before or during the pitch adjustment. However, the engine parameters remained near idle, while the pitch angle increased to maintain altitude. This led to a decrease in speed, resulting in the activation of the first Stick Shaker. In the prevailing weather and flight conditions, the pilot should have acted more cautiously by increasing throttle before or simultaneously with the pitch adjustment.

Assumption 2: Anti-Ice System On, N1 < 55%

Under these conditions, the pilot's actions would be similar to the above scenario, but the aircraft's response would differ. The Stick Shaker activation would not occur in the same way because the wing profile and engine intake would be affected by icing, leading to a reduction in thrust and lift.

2-8-11: Examination of the Second Stick Shaker Activation

The combination of parameters, including Flap 5, Pitch > 8/1, and Roll > -26 degrees, caused the Stick Shaker activation speed to increase significantly. With a bank angle of 26 degrees, the speed at which the Stick Shaker activated increased noticeably. To recover from the Stick Shaker activation the bank angle should've been decreased, which would've decreased the speed of the stick shaker.

With the increase in pitch due to ice formation on the surfaces and the control surfaces at the rear of the aircraft, the amount of laminar airflow entering the engines decreased. This reduction in airflow caused a decrease in the EPR (Engine Pressure Ratio) of Engines 2 and 3. Similar to the first Stick Shaker event, the flight crew's strategy to recover from the Stick Shaker involved reducing the pitch angle and increasing the throttle. However, the pilot suddenly increased the throttle, leading to compressor stall or rollback in these two engines. At this moment, the pilot requested more power from the engines, and the flight engineer promptly complied.

According to the Operation Manual of the aircraft (Chapter 04-25-16, Page 1), the flight crew is explicitly prohibited from making sudden increases in throttle and pitch. Rapid increases in throttle and pitch can lead to snow entering the engines, which in this case resulted in a flameout of Engine 3. At the time of the throttle increase, the aircraft was in a left bank, and Engine 3 had a higher horizontal speed compared to Engine 1, causing Engine 3 to flame out before Engine 1.

Due to the design of the S-duct and S-duct bypass, snow and water were dispersed around Engine 2 and exited through the bypass duct without entering the combustion chamber. This prevented a flameout of Engine 2.

Assumption: Ignition On or Ignition Off

In adverse weather conditions, according to the Operation Manual, a sudden and rapid increase in throttle in either ignition on or ignition off mode can lead to a flameout. If the ignition is off, the likelihood of this occurring is even higher.

Second Stick Shaker Event

In the second Stick Shaker event, the anti-ice system was fully effective, and the N1 was certainly above 55%. No issues were observed with the fan blades of Engines 1 and 3, and both engines were functioning properly. Given that the fan blades were intact at the accident site, the possibility of FOD (Foreign Object Damage) from ice impacting the engines is unlikely, unless internal engine inspections reveal otherwise.

Based on the engine parameters at all flight levels, whenever the crew attempted to increase or decrease engine thrust, the engines responded appropriately. Therefore, we conclude that the engines were in ideal condition. Additionally, from the flight crew's

conversations, we deduce that the aircraft did not experience any technical malfunctions, and there was no mention of the continuous ignition system in the discussions.

Conclusion of the Aircraft Systems Group:

Before the incident, the IRP (Incident Review Panel) in the hydraulic and pneumatic systems section, considering the flight conditions of aircraft, relied more on it because there was a possibility of wing and Anti-ice duct freezing, and Bleed Air from the engines was present under pre-incident conditions. Therefore, the performance of the system has been mentioned and analyzed in the Air Condition and Anti-ice sections for the systems.

The performance of the avionics systems has been referred to, analyzed, and concluded.

Iran Air, over several years, based on investigations conducted, has identified defects in the entire fleet of B727 aircraft related to the Bleed Air system, including:

1. Window overheat
2. Anti-ice duct overheat
3. Wing anti-ice trip

The most frequently observed issue was the Window overheat, and in some cases, the problem was a partially open Window overheat, which required the replacement or servicing of the shut-off valve. The Cowling Anti-ice system operates in such a way that the switch on the overhead panel controls the Eng. Cowl Anti-ice Valve. These switches are in two states, open and closed, and a control valve is used to open the air path. Above each switch, there is a green indicator light that turns on if the valve position matches the selected state; otherwise, the light remains off. If the valve is partially open, the green light does not stay on. In the case of this aircraft, it can be concluded that if the Eng. Cowl Anti-ice Valve was partially open, the absence of the green light in the cabin would indicate the issue, as mentioned in the CVR (Cockpit Voice Recorder) conversations. Therefore, under flight conditions, the valve was open, which was also observable from the engines.

Regarding AD (Airworthiness Directive), it was determined that the wing anti-ice automatic trip-off switch on Iran Air's B727 aircraft was addressed by issuing EA (Engineering Authorization) No. 727-30-009 dated 28/OCT/78. The operation of this system was such that when the ambient air was warm, the system would trip automatically, deactivating the system. Currently, the wing anti-ice system for B727 aircraft is operated manually. Therefore, there was no issue related to this aircraft in this regard.

The maintenance records and inspections conducted on this aircraft indicate that all parts related to the systems have been fully inspected and have the necessary cycles and functions. The remaining evidence and investigations show that all aircraft systems (hydraulic, pneumatic, and avionic) were active and functioning correctly until the last moment.

2.9 Powerplant Group Report

General Information:

The aircraft, registered as EP-IRP, is a Boeing 727 equipped with three Pratt & Whitney JT8D-15 model engines, which are low bypass twin-shaft engines producing a maximum power of 23,380 lbs. These engines are installed at the rear of the aircraft.

Engine Records:

Engine No. 1:

Engine No. 1, with serial number 334, was manufactured on August 13, 1981, and installed on the aircraft EP-IRP on May 22, 2010. The total flight hours of Engine No. 1 were 247 hours and 58 cycles at the time of installation. The engine had 193 hours and 103 cycles since its last major overhaul on February 16, 2006. From the date of installation until the day of the incident, it had accumulated 142 hours and 128 cycles.

Engine No. 2:

Engine No. 2, with serial number 754, was manufactured on March 19, 1975, and installed on the aircraft EP-IRP on May 23, 2010. The total flight hours of Engine No. 2 were 394 hours and 33 cycles at the time of installation. The engine had 553 hours and 37 cycles since its last major overhaul on February 20, 2009. It had no flight hours before installation on the aircraft. From the date of installation until the day of the incident, it had accumulated 142 hours and 128 cycles.

Engine 3:

Engine 3 of the aircraft, serial number 87391, was installed on the aircraft on 17th August 2010 (2nd of Shahrivar 1389). The total flight hours for Engine 3 were 7,897 hours, and the total flight cycles were 27,124 cycles. The engineâ€™s operational hours after its last major overhaul on 1st December 2002 were 7,897 hours and 27,124 cycles. From the installation on the aircraft until the day of the accident, it had 122 hours and 128 flight cycles.

Analysis and Review:

7. Analysis and Review of Technical Records

Based on the information and documents available from the Islamic Republic of Iran Air, including technical records for the Boeing 727 aircraft registered EP-IRP, such as the technical logbooks and flight reports, the following points are observed:
â€¢ A review of the OP1 records for the aircraft, from 7th December 2010 (1st of Azar 1389) to 19th January 2010 (19th of Dey 1389), shows that during this period, the following issues were recorded by the flight crew:

Measure against Issue	Description of Issue	Date	OP1	Engine	Number
Ind. Changed and adjusted	#1 Eng Oil Qty Ind. is unreadable	12.7.2010	37	1	1
Wiring problem rectified OP & BK GRD LIT checked OK	#2 Fuel Qty Ind. BK GRD LIT is out	12.7.2010	A037	2	2
2# Eng T/R deactivated MEL.	There is no control on #2 Eng. T/R second detend	12.17.2010	38	2	3
3# Engine low pressure SW replaced during motoring ckd. ok	Eng. #3 low oil press. Lit. Remains Ill up to 2 mints. After Eng. start	12.20.2010	A040	3	4
Eng. #2 T/L cable tension adjusted and spring back backlash ckd. Ok	Eng. #2 T/L has no backlash	12.20.2010	B040	2	5
Both #1 & #3 Engs. EPR & accuracy & Eng. Trim run c/out as per AMM	A/C requires 1.5 unit of R.rud trim of fly wing level. it is due to Eng #1 & Eng #3 assy	12.20.2010	B040	1 and 3	6
#3 Eng. Chkd oil press normal & oil press SW elect. Conn. chkd. Ok.	33Eng. Low oil press. Lit. remain on after Eng. Start for few mins	12.26.2010	46	3	7
Eng. #1 oil press Ind. Changed, checked during motoring found Ok	#1 Eng. Oil press Ind. Is unrelyable	1.1.2011	56	1	8

Eng. #1 oil press tx conn. Cleand ckd found ok	Ref to pp Item #2 &#1 Eng. Oil press indication unreliable	1.2.2011	57	1 and 2	9
Anti ice vlv of eng. #2 changed op chkd. Found ok	#2 Eng. Cowling anti ice valve oper. Is intrerm	1.8.2011	69	2	10

Given the 10 reported issues (see table above) by pilots who have flown this aircraft, it is evident that the most significant problem reported after the installation of the engines until the time of the incident was a lack of thrust coordination in engines No. 1 and 3. This issue was resolved by adjusting and recalibrating the engine control systems.

Additionally, the review of the installation documents (checklists No. D754-7004) for each of the three engines revealed that the engines were properly adjusted at the time of installation, and no specific issues were reported.

Analysis and Examination of Fuel Consumption:

Considering that the data from the Flight Data Recorder (FDR) indicates a loss of power in engines No. 1 and 3 at the time of the incident, one possible hypothesis is a problem with the aircraft's fuel consumption. It should be noted that this hypothesis is not confirmed because engine No. 2, which used the same type of fuel, was operational until the last moment. However, for further investigation, a request was made via letter No. 500/116 dated November 11, 2010, to the Petroleum Products Department of Iran at Mehrabad Airport to provide a list of aircraft that had received fuel 4 hours before and 4 hours after the incident and to introduce expert fuel chemistry specialists to assist in the necessary tests. After receiving the list, it was determined that aircraft that had received fuel from the Petroleum Products Department of Iran on the same day did not encounter any specific issues in this regard.

Furthermore, a meeting was held on December 7, 2010, with two experts from the Petroleum Products Department to review the documents related to the fuel used in the aircraft. The results indicated that the fuel delivered to the aircraft, based on the tests conducted, was resistant to freezing up to a temperature of -60 degrees Celsius.

The fuel had resistance to freezing, and the water content was less than 10 ppm (volume of water in one cubic meter of fuel). The fuel delivered was JET A1. It is important to note that, according to the standards defined by the oil company, the fuel for passenger aircraft must withstand temperatures down to -49 degrees Celsius, and the water content should be up to 15 ppm.

Additionally, the team present at the accident scene collected some fuel from the aircraft's tanks and sent it to Panha Company for testing, but the results have not been reported.

Therefore, based on the mentioned points, the hypothesis of fuel freezing or issues with the fuel delivered to the aircraft is dismissed.

Analysis and Examination Based on Accident Scene Information:

Another hypothesis under investigation is the detachment of the engines from the aircraft, which is detailed separately for each engine below.

Engine No. 1:

During the examination of the accident site and the aircraft's wreckage, it was observed that Engine No. 1 and its main components, including the Air Intake, LPC, HPC, Hot Core, and T/R, were found near the impact site close to the fuselage. This indicates that the engine remained attached until the aircraft hit the ground.

Additionally, the compressor blades of the engine, which were visible without auxiliary equipment, were almost undamaged within the engine structure, suggesting that the engine was shut down at the time of impact. This is confirmed by the data from the FDR (Flight Data Recorder).

Engine No. 2:

Engine No. 2 and its main components, including the Air Intake, LPC, HPC, Hot Core, and T/R, were also found at the impact site, connected together, indicating that the engine remained attached to the fuselage at the time of the accident. Given that most of the compressor blades or stages of this engine were damaged and broken, it can be concluded that this engine was operational at the time of impact. This is also confirmed by the data from the FDR.

Engine No. 3:

The condition of Engine No. 3 was similar to that of Engine No. 1. Upon examining the accident site, it was determined that the main components of this engine, including the Air Intake, LPC, HPC, Hot Core, and T/R, were found near the point of impact, connected together. The compressor stages were almost intact, indicating that the engine remained attached to the fuselage and was not operational at the time of the accident.

For further investigation, it was requested that Engines No. 1 and 3 be sent to reputable domestic or international scientific and technical centers to identify any internal issues. This topic is explained in section 1-17.

Analysis Based on FDR Data:

Based on the results from the FDR (Flight Data Recorder) and the investigations conducted, the following points can be highlighted. It is important to note that, unfortunately, due to the limitations of this model of FDR in recording sufficient data on engine performance, a highly accurate analysis was not possible. The only parameter

recorded by the FDR was the Engine Pressure Ratio (EPR), and the analysis was based on this.

At 15:56:07, the flight crew, due to the incomplete landing process or the decision to abort the landing (Missed Approach), decided to either attempt another approach or return to the origin. By 15:56:23, the EPR ranges for the aircraft's engines were as follows:

- Engine No. 1: 1.24 to 2.11
- Engine No. 2: 1.22 to 2.13
- Engine No. 3: 1.27 to 2.11

According to the charts in the Operations Manual (Flight Operations Manual) and considering the atmospheric conditions (temperature around -10 degrees Celsius) and the flight altitude above sea level (approximately 7000 to 8000 feet above the airport elevation), the minimum EPR for Engines No. 1 and 3 should have been around 2.30, and for Engine No. 2, around 2.33.

Given that the aircraft was flying in cold weather with the potential for icing on various parts, the cabin air conditioning system (Air Condition) and the anti-icing systems for the engine intakes and wings (Engine Anti-Ice and Wing Anti-Ice) should have been operational. The flight crew should have kept these systems on for at least 15 seconds.

From 15:56:25 to 16:00:40, while the flight crew was engaged in the operations related to the approach and maintaining altitude, the EPR ranges for the engines were as follows:

- Engine No. 1: 1.30 to 1.72
- Engine No. 2: 1.25 to 1.73
- Engine No. 3: 1.36 to 1.76

According to the defined ranges in the aircraft's operational manual, the EPR should have been maintained within these limits. However, due to the lack of documented parameters, it is difficult to provide a definitive opinion. Nevertheless, the low EPR values of the engines in the prevailing weather conditions likely reduced the effectiveness of the aircraft's anti-icing systems.

At 16:00:41, a stick shaker (vibration in the control column) occurred, and within 3 seconds (by 16:00:44), the crew increased the engine power. The EPR values of the engines increased from (1.30, 1.26, 1.36) to (1.46, 1.48, 1.53).

After the increase in engine power, due to the ingestion of turbulent air, the EPR values of the engines decreased to around (1.06, 1.16, 1.08), leading to a compressor stall.

At 16:00:50, the crew requested an increase in power to the "Firewall," and the flight engineer promptly executed this. All three engines began to gain power, but due to the intense ingestion of turbulent air and the turbulence over the wings (possibly covered with ice), Engine No. 3 lost power and was unable to generate thrust. Five seconds later, a similar event occurred with Engine No. 1, and it also failed. Subsequently, only Engine No. 2 remained operational, but it was insufficient for the required maneuvers.

Considering the above points and the strong recommendations from the aircraft manufacturer to avoid sudden increases in engine power, especially in weather conditions prone to icing on the engine intakes and wings, it can be concluded that:

- Insufficient engine power in the period before the impact (approximately 10 minutes) reduced the effectiveness of the aircraft's anti-icing systems and created conditions for ice formation on the engine intakes and wings.

Engine No. 2:

Due to the presence of an S-Duct (a connecting channel from the air intake to the engine intake), an increase in temperature of the incoming air prevented Engine No. 2 from freezing.

Conclusion:

a. The investigations conducted on the engines, their technical records, and their performance up to the day of the incident rule out the possibility of technical defects in the engines.

b. Based on the investigations of the aircraft's fuel and the documents provided by Mehrabad Oil Company, the hypothesis of issues with the aircraft's fuel is also incorrect.

c. The parameters recorded in the FDR (Flight Data Recorder) for the engines are insufficient to analyze the performance of these engines.

2.10 Human Factors Group Report

2.10.1 Human Injuries

After the incident involving the Boeing 1377 aircraft of Iran Air, the accident site was carefully reviewed. The nature of the incident was such that the front of the aircraft collided with a hard object, and due to the conditions inside the aircraft, where passengers were wearing seat belts, 78 occupants lost their lives, and 27 were injured.

Injuries	Flight Crew	Cabin Crew	FSO	Passenger	Total
Fatal	3	5	2	68	78
Serious	0	1	1	25	27
Minor	0	0	0	0	0
None	0	0	0	0	0
Total	3	6	3	93	105

The nature of the injuries and their distribution indicated that most injuries were to the lower limbs, abdomen, head, and neck. The bodies were found at the accident site, mostly on the seats and inside the aircraft.

2.10.2 Medical and Clinical Information:

After the incident, rescue operations were carried out by local forces, the Red Crescent, airport personnel, law enforcement, and emergency medical services from the city. The deceased victims were collected, categorized, and transferred to the forensic medicine department in Urmia. Survivors were taken to medical centers, including Imam Hospital, Imam Reza Hospital, Arefian Hospital, Azerbaijan Hospital, and the military hospital. Some of the injured, who were in critical condition, were placed under intensive care in ICU units. On October 20, 2010, the Deputy of Flight Standards issued a letter (No. 9022/27693000) to the Human Factors Group of the accident investigation team, granting the necessary permissions for interdepartmental cooperation from the West Azerbaijan Prosecutor's Office. Following this, the necessary permissions were obtained, and the following actions were taken at the forensic medicine department:

- Assessment of the victims' conditions and examination of the most severe injuries to various body parts.
- Determination of the cause of death, which was due to impact with a hard object.
- Preparation of slides from the bodies with coding.
- Request for autopsies, toxicology tests, and general drug dependency assessments, which were carried out.

2.10.3 Identification of Victims:

On October 20, 2010, the Deputy of Flight Standards introduced an aviation medical officer from the Human Factors Group to the forensic medicine department to follow up and handle related matters. The following steps were taken:

- Methods for identifying the victims.
- Location of the victims' bodies.
- Identification and collection of personal belongings left behind, gathering as much information as possible.
- Determination of the cause of death for the victims.

In response to the aforementioned letter, the forensic medicine department provided the following replies on October 27, 2010 (Letter No. 2689/10/640) and November 2, 2010 (Letter No. 5/8/8019).

Medical and Clinical Information:

1. Number of Victims: 78 individuals died, with multiple injuries primarily to the head, face, and limbs.
2. Cause of Death: The primary cause of death for most victims was multiple injuries and complications resulting from the impact.
3. Autopsy and Toxicology Results: The autopsy and toxicology results for the pilot and flight engineer, conducted using the JTC method, were negative. For the co-pilot, the TLC method was negative, but a weak positive result for diazepam was reported using the instrumental method.
4. Injured Individuals: 27 injured individuals were treated in various hospitals in the city, with injuries primarily to the head, face, and limbs.

2.10.4 Pilot Incapacitation:

Based on the investigations and the review of the CVR (Cockpit Voice Recorder) recordings, the pilot was in good physical, physiological, and mental health before the incident. There is no evidence to suggest any significant or mild incapacitation or mental impairment that could have contributed to the accident.

2.10.5 Discussion:

1. Incident Details: The accident occurred during the approach and landing phases. The injuries to the victims and survivors were extensive, particularly to the head, face, and limbs. The primary cause of death for most victims was multiple injuries. The bodies were not dismembered but were fragmented into four to six parts due to the impact with the ground and potential obstacles. Some seats remained in their original positions.
2. Pilot's Condition: The pilot's behavior, lifestyle habits, and personal events in the 24 to 72 hours before the incident were reviewed, and no abnormal behavior was observed.
3. Medical Records: The pilot and flight engineer were in good health, with no sensory impairments, drug dependencies, or signs of fatigue. The autopsy and toxicology results for the pilot and flight engineer were negative. For the co-pilot, the TLC method was negative, but a weak positive result for diazepam was reported using the instrumental method.

Cockpit Equipment and Environment:

3. Cockpit Equipment: The cockpit equipment, including seats, display screens, and control commands, met the defined standards. The cockpit environment, including noise and vibrations, showed no issues before the incident.
4. Cockpit Communications: In the recorded communications between the pilot and co-pilot, the co-pilot mentioned having taken three pills, to which the pilot responded that three was too many. It is unclear what type of pills were taken.
5. Identification Methods: The methods used to identify the victims included personal belongings, gender, age, clothing, and family assistance. The injuries to the victims' upper and lower body indicated that they were subjected to deceleration forces, with seat belts fastened, causing the passengers' bodies to move forward and bend.
6. Fractures and Injuries: Fractures and limb injuries occurred due to impact with parts of the seats or other sections of the aircraft.
7. Crew Coordination: The coordination between the pilot, co-pilot, and flight engineer was weak in terms of management.
8. Situational Awareness: Based on the review of the cockpit communications, it appears that the crew lacked situational awareness and failed to detect changes in the system, leading to informational errors. Additionally, the system's state was not accurately identified, resulting in operational errors.

Conclusion of the Human Factors Group:

1. Human Factors: While human factors do not appear to be the primary cause of the accident, they were a contributing factor.
2. Errors Contributing to the Accident:
   - Informational Error
   - Decision-Making Error
3. Medical Issues: No medical issues affecting the physical or mental health of the crew were observed.

2.11 Search and Rescue Group Report:

2.11.1 Information and Actions:

1. Emergency Declaration: Following the lack of response from flight IRA277 to the air traffic control tower at Urmia Airport and the tower's inability to determine the flight's position, an emergency was declared.
2. Initial Inspection: The airport's deputy operations manager, accompanied by a ground safety officer, immediately inspected the protective fence around the airport using a communication vehicle. They did not observe any unusual circumstances.
3. Weather Conditions: At the time, heavy snowfall was reported by the airport's meteorological department, with horizontal visibility reduced to 800 meters.
4. Preparedness: The air traffic controller, aware of the prevailing weather conditions and the sensitivity of the situation, had previously kept the airport's safety unit on standby at the station.
5. Flight Details: The aircraft in question was a B727, belonging to the Islamic Republic of Iran Airlines, with 105 occupants. It had flown from Tehran to Urmia, with an estimated landing time of 19:30 local time.
6. Crash Notification: At 19:48 local time, the ground safety officer received a phone call reporting the crash of the aircraft near the villages of Meshkabad-e Olya and Hasanlu.
7. Response Team: At 19:55 local time, the ground safety officer, accompanied by the airport's general manager and four ground safety personnel, along with a firefighting vehicle, headed to the accident site.
8. Additional Personnel: Other non-duty operational personnel were requested to quickly report to the airport and the accident site to assist.
9. Arrival at Scene: Despite the difficult path due to heavy snowfall and crowd congestion, the airport's ground safety team arrived at the accident site at 20:25 local time. They prepared to combat potential fires using dry powder and CO_2 cylinders and participated in rescue operations, successfully evacuating 21 survivors and 8 deceased from the site.

Search and Rescue Group Report:

Information and Actions:

9. Rescue Efforts: Initially, rescue and assistance efforts were carried out by the local villagers, followed by the Red Crescent, emergency services, and military and law enforcement personnel. Despite the challenging conditions, the injured were transported to hospitals, including Imam Khomeini Hospital, Motahari Hospital, Imam Reza Hospital, Shohada Hospital, Army Hospital, and Arefian Hospital.
10. Occupants: The aircraft had 105 occupants, consisting of 12 crew members, 90 adult passengers, 2 children, and 1 infant. Of these, 78 individuals lost their lives, and 27 were injured.

2.11.2 Analysis:

1. Preparedness: The ground safety unit at the airport was on standby 13 minutes before the estimated landing time of the aircraft, demonstrating the importance and attention given to their duties by the air traffic control unit in the context of Alerting Service. This reflects a commendable level of safety awareness and preparedness.
2. Readiness: Maintaining a state of readiness by positioning ground safety vehicles outside the station and within the parking area, as well as calling in non-duty personnel, shows a commendable level of dedication and responsiveness. Their prompt action in responding to the call and participating in rescue and relief efforts is noteworthy.
3. Emergency Signal: Despite the activation of the ELT (Emergency Locator Transmitter), no emergency signal was received from the COSPAS-SARSAT satellites by the country’s RCC (Rescue Coordination Center) or the aviation organization at the country’s airports.
4. Emergency Plan: The airport’s emergency plan (Airport EMG.Plan) has not been reviewed or updated.

3. CONCLUSIONS

3.1 Findings

1. During the execution of the approach plan for landing at Urmia Airport, a first-stage stall warning (Stick Shaker) appeared in the aircraft's commands. This issue was resolved by correctly adjusting the flaps, which had been neglected, considering the aircraft's speed.

2. During the approach to Urmia Airport, due to human error (pilot's actions), the aircraft was not aligned with the correct landing plan (ILS Inbound Course) at this airport. Consequently, the flight crew decided to abort the landing (Missed Approach).

3. At 16:00:41 UTC, during the Missed Approach, despite the altitude of 8768 ft, the aircraft experienced a second Stick Shaker event with Flap:5[0], Left Bank Angle: 26, and Pitch: 8.1 (within the permissible operational range at a speed of 170). This indicates a decrease in altitude and proximity to stall speed.

Note: At this time, with Flap 5 Deg, the aircraft's normal maneuvering speed should have been 160 Kt. However, the aircraft was at a speed of 170 Kt, which is significantly lower than the normal speed for Stick Shaker activation.

4. A change in the aircraft's aerodynamic state, likely due to icing on parts of the aircraft such as the tail section (which lacks an anti-ice system), caused an increase in speed, leading to the activation of the Stick Shaker.

5. After the second Stick Shaker, the EPR (Engine Pressure Ratio) of all three engines increased to 1.53, 1.48, 1.46 for one second, then decreased to 1.06, 1.07, 1.05 over four seconds. This could be due to turbulent air entering the engines during an increased bank angle of 26 to 40 degrees, leading to a leftward stall.

6. At 16:00:50 UTC, 9 seconds after the stall warning, the pilot ordered maximum power to recover from the stall. Initially, the EPR reached 2.14 by 16:00:53. However, due to

turbulent air entering the engine, the EPR parameter decreased, leading to the loss of engine number one by 16:00:55. Five seconds later, engine number three was also lost.

7. With the occurrence of the Stick Shaker, the second pilot was forced to request an increase in engine power. Based on the FDR (Flight Data Recorder) information, the EPR (Engine Pressure Ratio) parameter of the engines increased from 1.21, 1.36, 1.09 to 1.35, 2.06, 2.14 within 2 seconds, indicating the crew's response to increase engine power by rapidly accelerating the throttles. However, this action, given the turbulent air entering the engine intakes, could lead to engine flame-out, particularly affecting engines one and three.

8. At 16:01:07, the pilot commanded the use of maximum engine power. Only engine number two responded correctly, with its EPR reaching 2.11, indicating proper functioning of engine number two until the moment of the accident.

9. According to the aircraft manufacturer's training manual (FCT 727 Training Manual), in the Maneuver section, the pilot's policy was to increase engine power to recover the aircraft from a high pitch and bank angle. However, the pilot delayed the action of reducing the bank angle.

10. Given the existing conditions, including the loss of two engines, icing conditions, low speed (V=96 kt), and the aircraft's low altitude (approximately 600 ft above ground), the crew's decision to retract the flaps was incorrect. This action caused the aircraft to lose altitude more rapidly, although it did not prevent the accident.

11. The flight engineer, following the pilot's command, attempted to restart engine number one. However, due to the aircraft's low altitude and the short time before the accident, this attempt was unsuccessful.

Engine Number 1

Engine Number 2

3.2 MAIN CAUSE OF THE ACCIDENT

Engine number 3

The main cause of the accident was the adverse weather conditions affecting the aircraft and the improper response of the cockpit crew to the emergency situation, as detailed in section 3-1.

3.3 Contributing Factors to the Accident
- Outdated technology of the aircraft's systems.
- Lack of a suitable simulator for adverse weather conditions.
- Failure to correctly execute operational procedures by the flight crew.

4. Safety Recommendations

4.1 Civil Aviation Organization

1. The emergency signal from the aircraft's ELT (Emergency Locator Transmitter) was not received by search and rescue satellites, despite the ELT being activated on the 406 MHz frequency. This issue should be seriously pursued by the Civil Aviation Organization, and the organization should consider joining the COSPAS-SARSAT satellite system.

2. The emergency landing plan for Urmia Airport, as well as all other airports in the country, should be reviewed and approved by the Civil Aviation Organization (Office of Air Traffic Operations Supervision).

3. Necessary policies should be implemented in airlines to address the aging fleet.

4.2 Islamic Republic of Iran Airlines

1. The company must fully implement all instructions issued by the Civil Aviation Organization (CAD 2213) regarding the preservation of the accident scene, assistance to the injured, and other related measures.

2. The company must ensure that the Emergency Response Plan (ERP) approved by the organization is fully communicated and trained to all sub-sections, so that appropriate actions can be taken in the event of an accident or incident.

Operation Department

1. The Operations Department should execute the instructions of the organization (CAD 4206).

2. The Cabin Crew Unit should, based on CAD 4106, accurately record and document all pre-flight information, training, and medical details for each aircraft type.

3. Periodic retraining and evaluation of the flight crew's ability to handle difficult flight conditions, including winter operations, should be conducted.

4. The Quick Reference Handbook (QRH) should be reviewed and updated as necessary to suit various flight conditions.

Technical Department Responsibilities

1. A copy of the fuel receipt should be handed over to the first officer after refueling for their information, and it should also be returned to the dispatch office along with the flight file for recording.

2. The technical inspection checklist for flight operations in difficult and remote areas should be reviewed and updated.

3. The company's engineering unit should document all changes in the aircraft systems and ensure that these changes are recorded in the FDR (Flight Data Recorder) system in accordance with bulletin number 377.

4. The Flight Data Monitoring unit should conduct a more systematic analysis of the company's safety incidents.

5. The Quality Assurance Management should implement an Engine Condition Trend Monitoring (ECTM) program, tailored to available resources, to ensure engine quality control.

4.3 Airports of the Country

1. The operational safety and ground handling team at Urmia Airport (Air Traffic Control Tower) should be commended for their sensitivity and diligence in performing their duties by the Airports Company of the Country.

2. The ground safety unit of the country's airports should be equipped with standard airport runway vehicles and rescue vehicles by the Airports Company of the Country to facilitate rescue and relief operations.

5. Appendices

1. Photos of the Accident Site
2. Synchronized analysis table of CVR AND FDR (not included, if needed, I will send pictures)

Initial Location of the Plane crash

Location of the Horiziontal Stabilizier aswell as the Elevator

Location of the Flaps (0 Degrees, retracted shortly


STAB TRIM
NORMAL
TAKE-OFF
CG %MAC
10 20 30 40
APL NOSE UP
APL NOSE DOWN
2011/01/18 19:31


2011/01/10 14:59